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Transactions of the Australasian Medical Congress
(British Medical Association)

Second Session: Dunedin, February 3 to 10, 1927

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SECTION III.—OBSTETRICS AND GYNÆCOLOGY.

UTERINE INERTIA: ITS THEORY, SYMPTOMATOLOGY AND CAUSATION.

By MARY C. DE GARIS, M.D., B.S. (Melbourne),
Geelong, Victoria.

(Continued from page 256.)

McCollum has proved the dependence of fertility, viability, lactation, duration of life and vigour and youth on diet. Specific defects injure all these capacities. Diet probably affects the process of labour also. The commonness of pain in labour and its variation in intensity in different women may be largely due to the variety of defects that may and do occur in daily diet especially in cities. Country women notoriously have easier labours than town women. It is probably not an accident that many of the recorded cases of painless or nearly painless labour occurred in vegetarians, wives of greengrocers or country women.

Theoretically both the mother and her baby may readily go short of certain minerals, the bone making lime and phosphorus, for the lime bearing foods are few and the necessity great. No doubt a shortage of lime will cause one character in labour, a shortage of iodine another and a shortage of both yet another and so forth. The clinical classification of average labour is a helpful preliminary to the search for specific causes.

The relation of focal sepsis to child-bearing requires a paper to itself. Some day I hope to write one on hidden dental sepsis and child-bearing, but a very little consideration will enable us to find a direct causative relation between the hidden dental abscess and the albuminuric or pyelitic pregnancy, the eclamptic or hæmorrhagic labour, the febrile puerperium and the weakly or dead baby. To my mind the rising death rate of Australian mothers is due, not to their medical attendants, but to the prevalence of filled and dead teeth (foreign bodies in teeth) among child-bearing women.

What comes immediately under our control in any case? The diet and the infections. Correct the one; abolish the other.

To learn the causes of painful inert labour we must make a team work research, clinical, laboratory, animal, electrographic, statistical (of labour).

To summarize: the conception of uterine inertia outlined above throws light on some hitherto incomprehensible facts; painless labours step into their natural place in the gradation of actual labour, "false pains" and after-pains are accounted for; the diversity in character of labour is accounted for by the natural variation in the symptomatology of uterine inertia which like any other clinical entity must express itself in varying degrees and forms; the rationale of the "test of labour" is plain to see; the delay in labour in normal pelves is explained in terms of uterine function; similar errors in function are responsible for perineal and vaginal laceration; the correlation between unhealthy pregnancy, painful or morbid labour, febrile puerperiums and weakly babies is made obvious, demonstrating that child-bearing is one clinical entity occurring in successive stages. The clinical classification lays a foundation for the diagnosis of specific causes. Labour pain is recognized as a delicate indicator of the systemic health of the whole nation, men as well as women. The analogy between cardiac and uterine action opens up wide and fruitful fields to be tilled by the physician and the physiologist. The whole attitude of the doctor towards labour is changed; he will cease to be satisfied with anything less than comparative ease of labour, excellence of recovery and vigorous infancy.

Perhaps among my hearers are some with greater opportunity and greater knowledge than myself, who will realize the fascination and the promise of such a clinical analysis as I have attempted, and will later throw light on such conditions as rigid *os*, Bandl's ring, production of unfortunate lies *et cetera*.

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POLIOMYELITIS.

By C. M. HECTOR, M.D., B.Sc.,
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POLIOMYELITIS is no new disease. Draper, in his monograph, states that the first observation of the clinical phase of the disease was probably made by Underwood, of Philadelphia, in 1774.

Underwood recognized that children might suddenly become paralysed after a brief illness, but his description was meagre.

We are told that Sir Walter Scott who was born in the year 1771, had a febrile illness at the age of eighteen months, that this illness lasted three days, at the end of which time he was found to have lost the power to move his right leg. But our conception of the disease has, in recent years, undergone a complete change. The disease has assumed epidemic proportions of increasing gravity.

It is not possible nor is it desirable to attempt in the time at our disposal in this conference to go over the whole subject of poliomyelitis.

I propose to confine my remarks to three aspects of the subject: (i.) The 1924-1925 epidemic in New Zealand; (ii.) experimental work at Otago Medical School, (iii.) the nature of poliomyelitis and allied affections.

The 1924-1925 Epidemic.

The 1924-1925 epidemic, though the worst, was not the first epidemic to be experienced by New Zealand.

The first epidemic occurred in 1914. Prior to 1914 scattered cases had been noted from time to time.

The epidemic of 1914 was confined to the North Island. Out of a total of sixty-five cases fifty-eight occurred in the Wellington Health District.

The next epidemic occurred in 1916.

This epidemic was fully reported for the Wellington District by Dr. Sydney Smith, District Health Officer, who states that in its development and progress it was much more violent than that of 1914.

In the early days poliomyelitis was recognised chiefly, if not wholly by the paralytic cases, whereas we now know that it is a specific infectious disease akin to influenza and that the paralytic cases form a small proportion only of the total cases of an epidemic.

In his report on the 1916 epidemic Dr. Sydney Smith estimated the number of non-paralytic to paralytic cases as twelve to one.

The 1924-1925 epidemic began, as is usual, in the late spring and ran through the warmest period of the year, declining with the advent of cooler weather.

In keeping with this fact it was noted further that the warmer parts of the country suffered more than the cooler.

The most comprehensive study of the epidemic for any district was that made by Dr. R. A. Shore in the Wellington Health District. I am indebted to Dr. Shore for much detailed information and for many valuable suggestions. Dr. Shore's report was incorporated in a general report by the Health Department, together with a clinical report by Dr. Robertson, of Wellington Hospital, and a pathological report by Dr. P. P. Lynch, of the same institution.

This report has been published by the Health Department, republished in full in THE MEDICAL JOURNAL OF AUSTRALIA and is to be reproduced by Draper in Nelson's "Loose Leaf Medicine." So that it is available and probably familiar to all who are interested in this subject. It was early recognised by the Health Department that the epidemic was likely to be a serious one and vigorous steps were taken to restrict it.

In conjunction with the New Zealand Branch of the British Medical Association, the Health Department issued a memorandum on the diagnosis of infantile paralysis particularly in the pre-paralytic stage to all practitioners: the schools and picture theatres were closed; the congregation and travelling of children was restricted as far as possible.

That these measures were justified and effective is shown by the fact that, whereas the case mortality was high, showing a virulent infection, the paralysis rate was strikingly low.

Many cases were noted of families in which a series of abortive cases led up to a paralytic case, that is, of instances in which the virulence of the infection increased where circumstances favoured it.

No doubt, had the above restrictions not been imposed, the virulence of the epidemic as a whole would have been exalted and the proportion of paralytic cases would have been increased.

It was noted that the number of non-paralytic cases increased towards the end of the epidemic. This was probably due in part to the freer recognition of pre-paralytic cases and in part to the benefit of serum treatment which is more effective the earlier it is given.

The Health Department issued to all its District offices in March, 1925, a *questionnaire* of fifteen headings relating to the disease.

I have been favoured by Dr. Watt, Deputy Director-General of Health, with the reports received in reply.

As these replies carry us a stage further than the report on the epidemic to which I have already referred, a summary of them under the headings of the *questionnaire* may serve to bring out the salient features of the epidemic.

1. There was practically no poliomyelitis in New Zealand in 1924 until the epidemic broke out in Wellington on November 25.

2. The maximum incidence of the epidemic coincided with the warmest period of the year, that is, the end of February.

3. The sexes were about equally affected; there was a slight preponderance of males.

4. Age; on an average 89% of the patients were under sixteen years.

5. As to the proportion of mild and severe cases, no figures were available, but the impression of all officers was that mild cases were very numerous.

6. The average recovery rate in cases notified was 84%.

7. Infection was found to occur chiefly by contact with patients or carriers; to a slight extent by convalescents.

8. Missed cases.—There were numerous cases of mild illness which were probably poliomyelitis, though not notified as such. The average estimate of abortive to paralytic cases was eight to one.

9. The incubation period lasted on an average for three to four days.

10. The mode of spread is considered to be entirely by personal contact; there is no evidence to implicate insects or fomites.

11. Social circumstances.—The disease was found to attack rich and poor alike; some of the worst slums escaped.

12. No general relation to population density was noticeable.

13. Multiple paralytic cases in one family were rare, but abortive, working up to paralytic cases, were common.

14. Hospitalization.—Of the notified patients 88% were treated in hospital.

15. Symptomatology.—The reports show that it was typical throughout.

Some further points emerge from the reports:—

16. The case mortality was as follows:

Otago and Southland Health District	12.37%
Canterbury and Westland Health District ..	13.4%
Wellington Health District	12.0%
Auckland (South and Central) Health District	22.0%
Auckland (North and Opotiki) Health District	17.8%
Average ..	15.5%

17. Human convalescent serum was found to be a specific in producing prompt recovery and in preventing paralysis if given in the pre-paralytic stage.

18. Early diagnosis by clinical observation and by lumbar puncture is essential for effective serum treatment.

To this it may be added that not only is early diagnosis essential for successful treatment, but also that the recognition as far as possible of cases of poliomyelitis, however mild, is essential to a correct knowledge of the incidence, spread and mortality of the disease.

Experimental Work in Dunedin.

By the aid of a Government grant and the generous assistance of Professor Hercus and his staff, it has been possible to continue in Dunedin the experimental work initiated in Wellington by Dr. Lynch.

The objectives set out for research were numerous, but broadly they were directed towards:

1. Detection of early cases of the disease.

2. Detection of carriers and very mild cases.

3. Discovery of some test for recognizing susceptibles and non-susceptibles on the lines of the Schick test.

4. Immunization of susceptibles.

Work commenced in May, 1925, with material supplied by Dr. Lynch upon monkeys handed over by him. Further supplies of monkeys have been obtained from Sydney and Calcutta, and fresh material has been obtained from patients with poliomyelitis in Dunedin Hospital. A special house for accommodating the animals has been erected at the Medical School.

Protocols.

The following brief outlines of the experiments show the results obtained.

Monkey 1 inoculated on June 16, 1926, with 5% emulsion of the spinal cord of patient who had died in Dunedin Hospital. The inoculation was made intracerebrally in the usual way.

Result.—The animal had diarrhœa and was huddled in a corner on the ninth and tenth days after inoculation. It then recovered and remained well. On subsequent inoculation on October 18, 1925, it showed no illness. Presumably it suffered from an abortive attack.

Monkey 2 died under the anæsthetic.

Monkey 3 was inoculated on June 25, 1925, with Noguchi culture of nasopharyngeal washings. Globoid bodies had been found in the culture.

Result.—Offensive diarrhœa and shivering were noted on the fourteenth day after inoculation; recovery. Presumably an abortive attack.

Monkey 4 received an injection identical with that given to Monkey 1.

Result.—On the thirteenth day there was definite nervousness and the animal had a wild look. This continued for about a week or ten days; recovery.

This may also have been an abortive attack; nervousness has been noted by other workers.

Monkey 5 received an intracerebral injection of one cubic centimetre of 5% emulsion of spinal cord of a patient who had died, together with a similar quantity intrathecally and hypertonic saline solution intravenously.

This monkey remained well till the twenty-fifth day, when flaccid paralysis of the right arm suddenly developed. A day or two later after being photographed and cinematographed, it was killed with chloroform. *Post mortem* changes typical of poliomyelitis were found in the spinal cord. The cord was preserved in glycerine for further inoculation..

Monkey 6 was inoculated with Noguchi culture of the same cord as was used in Monkey 5. One and a half cubic centimetres were injected intracerebrally and ten cubic centimetres intraperitoneally. On the fourth day this animal looked ill. On the fifth day it was drowsy, leaning against the wall of its cage and nodding: its attention could not be attracted: there was complete extension of the fingers of the left hand at the metacarpo-phalangeal joint. This spastic condition continued till the tenth day, when it passed off. The animal recovered and remained well. Was this a case of localized cerebral infection or was it traumatic? The symptoms suggest infection and, moreover, the site of inoculation was high up on the right parietal region and should have involved the left leg.

Monkey 7 was inoculated with a nasal swab from a patient with acute poliomyelitis. The swab was taken from the child and placed in the monkey's nose for twenty-two hours. The animal looked ill on the fourth day, but was better next day and showed no further symptoms. This may have been an abortive attack. *Post mortem* there were no lesions in the central nervous system.

Monkey 8 was inoculated intraperitoneally with naso-pharyngeal washings from the same patient as Monkey 7.

No illness followed, but this animal was used in experiment 3 and may have been immune.

Monkey 9 was inoculated intracerebrally and intrathecally with naso-pharyngeal washings from a sister of the patient referred to in the two preceding experiments; she was suspected of having had an abortive attack. This animal showed traumatic paralysis on recovery from the anæsthetic, but no symptoms of poliomyelitis.

Monkey 10 was inoculated intracerebrally and intrathecally with filtrate of fæces of the patient used for Monkey 7. On the fifteenth day it was "off colour"; on the seventeenth and eighteenth it was "better," but on the nineteenth day paralysis of the right leg and weakness of the left hand appeared. On the twentieth day the monkey was ill with loose offensive motions. On the twenty-first day both hind limbs were trailing. Loose offensive motions and increasing weakness continued till death on the twenty-fifth day.

Changes were found *post mortem* in the spinal cord suggestive of poliomyelitis in the subacute or late stage.

Monkey 11 was inoculated intracerebrally with emulsion of spinal cord of Monkey 5 (dead of poliomyelitis).

Result.—On the fifth day paralysis of the left leg appeared; this continued in varying degree for twenty days and then cleared up.

Monkey 12 was inoculated with an intranasal swab from a patient in Dunedin Hospital.

Result.—No infection.

Monkey 13 was inoculated with filtrate of fæces of Monkey 10; intracerebral and intraperitoneal injections of virus together with intravenous injections of hypertonic saline solution were given.

Result.—No infection.

Monkey 14 received an intracerebral inoculation of naso-pharyngeal washings from a patient.

Result.—From the sixteenth to the twenty-first days spasms followed by paresis of the left arm and leg were noted.

Monkey 15 died of cerebral hæmorrhage the day after operation.

Monkey 16 was inoculated with emulsion of spinal cord of Monkey 5. One half of a cubic centimetre of filtered emulsion was injected intracerebrally and three cubic centimetres intrathecally after lumbar puncture and injection intrathecally of two cubic centimetres of normal horse serum to break down the barrier at the chorioid plexus. An equivalent amount of cerebro-spinal fluid had been withdrawn.

No illness followed, but this animal had been used in experiment 4 and may have been immune.

Monkey 17 was inoculated on June 2, 1926, with emulsion of spinal cord of a monkey successfully inoculated by Dr. Lynch. The cord had been preserved in glycerine since February 16, 1924.

Result.—No infection.

The inoculation was repeated on June 22, 1926, through the same trephine opening again with no infection.

In addition to the above experiments endeavours have been made to inoculate rabbits with virus in various forms. In some rabbits it was attempted to lower their resistance by prior injection of morphine in increasing doses, but no infection was produced.

Tests for skin reactions were made on monkeys and rabbits with known virulent suspension of spinal cord in the form of filtrate, Rosenow's antipoliomyelitic serum and normal horse serum as a control being used, but no reactions were obtained.

From the above experiments it may be concluded that the virus was undoubtedly present, but that its virulence was of a low order, not sufficient in fact to give the rapid propagation of the disease required for the purpose of immunity tests.

Attempts to exalt its virulence by passage were unsuccessful.

The only effect apparently was to immunize the monkeys by mild attacks. This could not be verified in the absence of a virulent strain; the inoculations have therefore been discontinued till fresh virulent material is available.

The Nature of Poliomyelitis and its Relation to Allied Diseases.

Poliomyelitis is a member of the group of epidemic diseases of the central nervous system.

Allied to it are cerebro-spinal meningitis, *encephalitis lethargica*, influenza, rabies and a large group of diseases due to filter-passing organisms.

Some of these are of recent origin and several of them show increasing epidemic prevalence and severity. It is even said that measles which is one of them, shows an increasing severity. Why is this?

The subject is discussed by MacNalty in the Milroy lectures for 1921. He is clearly of opinion that they are on the increase. He discusses various explanations such as:—(i.) Lowered resistance of the central nervous system owing to modern conditions of life, (ii.) increased facility of infection by reason of modern transport facilities, (iii.) cyclical variation in the virulence of organisms, (iv.) new species of organisms—and so on.

Encephalitis lethargica, the most devastating and deplorable of all, appeared first in 1916 and has increased by leaps and bounds.

Some have thought that cerebro-spinal meningitis, poliomyelitis and *encephalitis lethargica* are due to a common cause and in some way related to influenza, but the seasonal occurrence of poliomyelitis and *encephalitis lethargica* is not the same and cross immunity experiments tend to show that they are distinct, though perhaps related, as some suggest, in the same way as typhoid fever and paratyphoid fever.

There are many similarities between these diseases and the boundary lines are ill-defined. All are naso-pharyngeal infections in the beginning.

Confining our attention to poliomyelitis, we may picture the organism lodging first in the naso-pharynx. Here sufficient toxæmia may be produced to lead to systemic disturbance of trifling or severe degree. It has been shown by Amoss that the nasal secretion has a neutralizing action on the virus. By this means and by a general reaction of the system the disease may be cut short at this stage; this gives us the so-called abortive form. From the naso-pharynx the infection may be spread directly to the central nervous system by way of the olfactory nerves or it may spread indirectly by way of the bowel. Infective secretion from the naso-pharynx is swallowed and the infection probably passes up the nerves to the spinal cord. It may reach the lower end of the cord and cause damage chiefly in the lumbar enlargement or it may spread up the cord to the cervical enlargement and even to the medulla, where by involvement of the respiratory centres it invariably causes death.

In the invasion of the central nervous system we note a stage of meningeal irritation: the disease may be arrested at this stage; on the other hand in fulminant cases the meningeal stage may be obscured. The frequency of involvement of the lower segments of the cord points to frequency of infection by the indirect route and emphasizes the practical importance of Dr. Shore's observation that a sharp purge was often followed by a large offensive evacuation and rapid amelioration in the condition of the patient.

Death by involvement of the vital centres must be regarded as a matter of chance and to that extent an accident. In *encephalitis lethargica* we note the frequent occurrence of conjunctivitis and involvement of the centre of the oculo-motor nerve. Goodpasture has shown that in *herpes labialis* the infection actually travels along the axis cylinder of the nerve.

The important fact about poliomyelitis from an epidemiological point of view is that the disease may be and almost certainly is spread largely by patients with mild unrecognized infection and by contact carriers.

In this connexion my attention has been drawn by Dr. Shore to two valuable pieces of work on the spread of epidemic disease; namely (i.) "Experimental Epidemiology" by Professor Topley, being the Milroy lectures for 1926, (ii.) the special report of the Medical Research Council (No. 75) by Surgeon-Commander Dudley, R.N.

By experiments on mice Topley shows that in a limited herd an epidemic tends to die out, leaving a variable percentage of survivors; that an epidemic is kept going by the regular importation of fresh susceptibles and that the herd will thus be brought nearer and more rapidly to extinction; that the initial mixture of infected with susceptible hosts is followed by a pre-epidemic phase in which apparently sporadic cases of the disease occur.

He produces evidence to show that there is widespread infection of the herd and development of immunity with in the majority of cases insignificant symptoms of disease. Further, that to be effective in limiting the disease dispersal of susceptibles must be carried out in the pre-epidemic stage of the disease; also that it is not necessary to suppose that contact with a clinically recognizable case of the disease is the main mode of infection. He states that in cerebro-spinal meningitis the carrier-rate is observed to rise to 20% before a single case of the disease occurs.

Dudley brings out the importance of crowding in relation to infection. He calls attention to a new principle which he calls "velocity of infection." This he describes as the resultant of two other velocities. In many or all infectious diseases a certain "minimal infective dose" is necessary to produce the disease. A less amount is destroyed by the defensive mechanisms. But subminimal infective doses may be accumulated till they exceed a minimal infective dose. If collected faster than the defensive mechanism can deal with, then disease ensues. We have therefore V=velocity of reception of infection, U=velocity of destruction of infection. If U exceed V no infection follows; otherwise the velocity of infection depends on $V-U$.

If the margin is very small, we may get the production of immunity without any obvious infection.

The bearing of these observations on poliomyelitis and allied diseases is patent to all.

Professor J. B. Cleland (Adelaide) said that he wished to know if inoculation experiments had been carried out with other animals besides monkeys. There were many persons attacked by encephalitis in New South Wales in the dry interior and the question arose whether the infections were due to the same virus. He thought that it was a separate disease, for it seemed possible to convey the disease from monkeys to sheep. Recently experiments had been carried out in the course of which the disease had been transferred directly to sheep. The question was whether it was possible to convey the virus of anterior poliomyelitis to sheep. This had not been hitherto successful, because of the few attempts made. Inoculation into sheep had revealed many interesting points. If six sheep were inoculated, the following results might be expected. At the end of seven days two sheep might suddenly manifest symptoms, head retraction, inability to stand up, convulsions and death. *Post mortem* typical lesions of encephalo-myelitis were found. Two others might manifest indefinite symptoms, instability and slight twitching; the other two might have no symptoms at all. If these last two were inoculated in another series, they would be still refractory. This raised the question as to whether in an epidemic some members of the community did not harbour the virus in the central nervous system. He thought that many people became infected and that the virus reached the central nervous system without any untoward symptoms. It was uncertain whether the lymphocytic involvement caused the paresis or whether the reaction of the individual rather than the effect of the toxin of the virus produced the symptoms.

Dr. A. H. Tebbutt (Sydney) said that it was difficult to distinguish between the cerebro-spinal fluid of tuberculous meningitis and that of anterior poliomyelitis. A careful examination of the fluid was always made for tubercle bacilli and in a few instances these were found. The fluid in anterior poliomyelitis might contain a veil-like clot and a large number of cells. In anterior poliomyelitis polymorphonuclear cells were increased, while in tuberculous meningitis lymphocytes were increased. This, however, might not always be evident.

Dr. C. M. Hector replied that with regard to Dr. Cleland's remarks he had not tried to inoculate sheep in his experiments. He had, however, tried to inoculate rabbits whose resistance had been lowered with large doses of morphine. In no case, however, did he get infection. He also gave *cannabis indica* to stimulate the cerebral circulation, but again he had obtained no infection.

No doubt some of the symptoms in anterior poliomyelitis were due to the œdema produced. When the œdema went down, some of the symptoms disappeared. There were many cells in a badly-infected area which appeared to be healthy and hence there was some recovery when the œdema passed off.

POLIOMYELITIS IN VICTORIA IN 1925: PRELIMINARY STEPS FOR OBTAINING BLOOD FOR THE PREPARATION OF IMMUNE HUMAN SERUM.

By Jean Macnamara, M.D. (Melbourne),
Melbourne.

In the first week of April, 1925, the Medical Superintendent of the Children's Hospital, Melbourne, Dr. R. Southby, reported in the daily press the admission to the hospital of twenty-three child-

ren suffering from acute anterior poliomyelitis. This number was greatly in excess of the average number of admissions during the autumn and it was felt that the possibility of an epidemic similar to that which had just occurred in New Zealand, had to be faced. In considering a policy for combating such an epidemic the following decisions were arrived at. It was considered advisable: (i) To obtain a supply of serum prepared from the blood of persons previously affected, (ii) to awaken the interest of the public and the profession to the importance of early diagnosis, (iii) to assist in early diagnosis by providing for any doctor who desired it, the services of a consultant, prepared to carry out lumbar puncture and examination of the cerebrospinal fluid in the patient's home, (iv) to take precautions in the distribution of the serum to guard against its use in cases where the diagnosis is not proven, (v) to keep careful clinical records in order to assess the value of the serum as a therapeutic agent, (vi) to use every opportunity of insuring adequate after care to the paralysed children.

The Search for Donors.

It was considered that the number of cases occurring in the late autumn and winter of 1925 did not justify a public appeal for persons suitable to act as donors of blood. It therefore became necessary to search through other channels. Through the notifications of the Department of Health and the generous cooperation of the staffs of the various public hospitals, the persons recently affected were traced without much difficulty. After several trials it was found that the technical difficulties of obtaining blood in quantities from children under the age of twelve years were too great to warrant further use of such children as donors. Twelve adults had been affected in the late summer and autumn of 1925 and these have proved our best donors.

Persons affected in previous years were traced through various channels. Names were obtained from the notifications as far back as 1917, from the records of out-patients and massage departments of public hospitals, from the Pensions Department and from splint makers and surgical bootmakers. In every instance a letter was written to the parents, explaining the nature of the request and asking for a reply of consent or refusal, together with the statement of age of the patient and the date of onset of the paralysis. Hundreds of these letters were returned through the dead letter office. Many refused to allow their children to give blood. However, if the age of the child was promising and the date of onset recent, the home was visited and in almost every instance when a verbal explanation was given, consent was not withheld. It was found necessary to verify the diagnosis by a careful clinical examination, as many of the names received were those of persons suffering from paralysis or deformities caused by diseases other than poliomyelitis.

These excursions into the suburbs, though most time consuming, were very profitable, as each person who had had poliomyelitis, whether recently or not, knew of others in the neighbourhood, many of whom had long since given up treatment. The visits in many instances resulted in another attempt being made to prevent increasing deformity and ameliorate crippling. Through these channels one hundred and ten donors were traced, persons willing to give blood, in whom the diagnosis had been verified by examination. These were classified according to the date of the onset. While those whose onset was recent, were regarded as the most valuable, it was at first necessary to call on some persons whose illness was of longer standing.

Serum prepared from the blood of persons whose onset occurred in 1925, was graded as Group 1, from persons attacked between 1923 and 1925, as Group 2, between 1918 and 1923 as Group 3 and before 1918 as Group 4.

Method of Obtaining Blood from Donors.

An afternoon was selected, convenient to the staff of the Walter and Eliza Hall Institute, the Commonwealth Serum Laboratories and the donors. Seven or eight were asked to attend at stated intervals at the institute. As many were severely crippled a motor car with a nurse in attendance was available to call for them at their homes and as a rule after blood had been given, the donors were driven home.

Technique

After the skin had been cleansed with acetone, cyllin and methylated spirit lotion, a tourniquet was applied to the arm and a needle inserted into the median basilic vein. The first few cubic centimetres to escape from the needle were collected in a tube for the Wassermann test and connexion was then made between the needle and the rubber tubing leading to the collecting vessel. It was not found necessary to cut down on the vein, blood being obtained in sufficient quantities by direct puncture. At first, however, some difficulty was experienced on account of clotting in the needle. To obviate this two platinium and iridium needles were obtained, but these, while having a smooth inner surface required repeated sharpening, the point being destroyed by use on one patient. At the time rustless steel needles could not be obtained in the large size required and some large needles made of nickel proved useful.

The Wassermann test was carried out by Miss F. E. Williams at the institute on each specimen of blood taken from each donor. The result was available thirty-six hours later, when the preparation proceeded. The amount of blood taken from each person varied from one hundred and twenty to three hundred cubic centimetres (four to ten ounces), depending on the physique and the nature of the donor's occupation. It was considered better policy to take a small amount of blood which did not interfere with the donor's ordinary mode of life and to repeat the bleeding some weeks later if necessary, than to make the process unpopular by taking larger quantities. Two patients fainted before one hundred cubic centimetres of blood had escaped, but otherwise no ill effects were noted. None of the donors asked for payment, but in four instances after blood had been given on more than one occa-

sion by persons who required money urgently for splints or callipers, a small remuneration was given. An effort is being made to keep in touch with these donors to record the frequent changes of address made by each one, in order that, should serum be required in quantity in the future, the tedious search for and verification of the diagnosis of these donors will be eliminated.

Dr. A. Jeffreys Wood (Melbourne) said that Dr. Macnamara had stimulated the Health Department in Melbourne and urged them to action in regard to the outbreak of anterior poliomyelitis. The City Council had appointed Dr. Macnamara to find out where serum could be obtained and where it could be put up in a suitable form for administration and had instructed her to be at the call of any practitioner who wished her to see a patient with anterior poliomyelitis. He had had only one patient. This was a small child of eighteen months which was quite healthy. It had suddenly lost its appetite and resented being disturbed. There had been some stiffness of the neck and spine and also some paralysis. Dr. Macnamara had been called in and immediate lumbar puncture had been performed and the number of cells in the cerebro-spinal fluid calculated. The diagnosis of infantile paralysis had been made and without removing the lumbar puncture needle serum had been injected into the theca. Serum had also been given into the muscles and veins. The child had begun to improve and in six months the weakness of the abdominal muscles had disappeared and no paralysis of the deltoid muscle remained. The action of the Council was to be praised; Dr. Macnamara had carried out most excellent and beneficial work.

COLLECTING BLOOD FROM DONORS AND PREPARATION OF CURATIVE SERUM FOR USE IN POLIOMYELITIS.

By F. G. Morgan, M.B., B.S. (Melbourne),
Director of the Commonwealth Serum Laboratories, Melbourne.

Early in 1925 the Department was approached by Dr. Macnamara with a view to arranging for the manufacture of serum obtained from human donors for use in cases of acute poliomyelitis. It was determined that every assistance should be given to the medical profession by the Serum Laboratories in this matter.

From a search of the available literature dealing with the collection of blood from patients convalescent from the disease it appeared that the blood removed was allowed to clot without the addition of any anticoagulant or other chemical substance. The reactions which occurred as a result of the injection of this serum, were reported as due mainly to the occurrence of hæmolysis which occurred during clotting.

I thought that ease of collection and transportation of the blood and an increased yield of serum would result if oxalate were employed as an anticoagulant. We were faced with the difficulty, however, when drawing blood from a vein of a human being that the flow is much less forceful and slower than when removed from the jugular vein of a horse owing to several factors. Difficulties arose owing to the premature clotting of blood within the needle and rubber collecting tubes. Certain precautions had to be taken to prevent this happening.

Dr. Macnamara has already mentioned in her paper some of the difficulties experienced in substituting platinum-iridium needles and rustless steel needles for those of the common steel variety. The steel needle is liable to rust and to present an irregular surface which facilitates clotting, the undesirable state of affairs we were trying to avoid.

The tendency to clot in the narrow collecting tubes was overcome to a great extent by immersing the apparatus in heated paraffin wax of suitable melting point. This procedure coated the apparatus very effectively with a thin film of paraffin wax.

Details of the preparation of the collecting apparatus are given below.

A few of the earliest samples of blood were collected without the addition of any anticoagulant, but we found very soon that the ease of handling and the absence of hæmolysis permitted by the use of potassium oxalate outweighed any possible disadvantages which might attend its use. The addition of such salts has been proved in the past to be quite harmless as employed when preparing serum.

A further difficulty was experienced when we tried to clot the plasma after the removal of the red cells. Certain slight adjustments had to be made with regard to the amount of calcium chloride which was necessary to produce rapid and complete clotting.

The result of experiment showed that we were able to obtain a fair percentage of curative serum from the whole blood which proved on administration to patients to excite no unfavourable reaction whatever, whether administered by the intrathecal, intramuscular or intravenous routes. The serum prepared was rendered sterile by means of filtration through Pasteur-Chamberland *F* candles. No antiseptic was added in view of the necessity of administering it by the intrathecal route. The usual tests for sterility carried out at these laboratories were employed.

Technical Details.

Apparatus.

Figure I is a diagram, lettered and numbered. The apparatus consists in the main of collecting

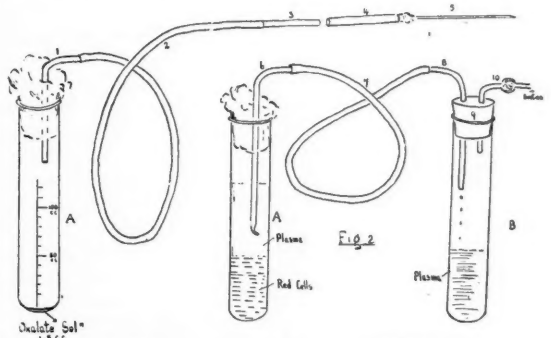

Figure I. Figure II.

Tube A for collection of blood from the vein, Tube B for collection of plasma, 1= glass tube (0·47 centimetre) to which is fitted 8·75 millimetre fine rubber tubing (2), 3 = small piece of glass tubing (0·47 centimetre), 4 = short piece rubber tubing connected with needle 5, 6 = glass tubing (0·47 centimetre) drawn to a fine curved point for siphoning, 7 = 8·75 millimetre rubber tubing, 8 = 4·7 millimetre glass tubing, 9 = rubber stopper to fit tube B, 10 = a glass tube fitted with a cotton wool plug for attachment to the suction apparatus.

tubes which are graduated suitably up to 120 cubic centimetres.

In the case of tube *A* a cotton wool plug is used through which passes a glass tube which may be used for the collection of blood from the vein. The size of these tubes is 20 centimetres by 3·75 centimetres.

Method of Using the Apparatus.

The whole of the apparatus employed must be clean and sterile. It is previously sterilized in an autoclave and then dried. It is necessary to coat that part of the receiving apparatus which will be brought into contact with freshly drawn blood with a thin layer of paraffin wax. This is effected by immersing completely the whole of the apparatus while disconnected in paraffin wax in a deep container. The container must permit of complete submersion of the apparatus which is held in such a position that all the air may be removed from the inside of the tube. After draining, the whole of the glass ware and rubber tubing will be coated with a thin film of paraffin. The paraffin used had a melting point of between 60° and 70°C..

After coating with paraffin the apparatus in Figure I is assembled together as shown. It is, of course, necessary to provide tube *A* with a fresh sterile cotton wool plug.

The melted paraffin is heated to 180°C. for one hour before immersing the apparatus, then cooled to 160°C. and the apparatus placed in it for waxing for at least two minutes. The rubber and glass tubing and tube *B* do not need to be waxed.

The method of using the apparatus is as follows.

One and a half cubic centimetres of a 10% solution of potassium oxalate is inserted into tube *A* by means of a pipette immediately before bleeding is commenced, the cotton wool stopper being removed for this purpose and then replaced.

The needle 5 with rubber tube 4 attached is then inserted into the vein of the donor after the necessary precautions for sterilization of the skin have been carried out. A small sample of blood is withdrawn for the Wassermann test and then the glass tube 3 is inserted into the open end of 4. The blood is allowed to flow by gravity into tube *A* which is kept gently agitated during the whole of the bleeding until the required quantity is obtained.

A spare tube, similar to *A*, is available. Should more blood than 120 cubic centimetres be obtainable, a simple transfer of the cotton wool plug and receiving tube to the fresh tube is all that is necessary, tube *A* being closed with the stopper removed from the tube substituted.

When the bleeding operations are completed, the receiving tube and cotton wool plug are replaced by a fresh sterile cotton wool stopper. The blood is then allowed to stand overnight and the red cells settle to the bottom. The supernatant plasma is then drawn off by means of the apparatus shown in Figure II. Suction is applied to tube 10 and care is taken to avoid drawing up the red cells. The red cells remaining in tube *A* are then centrifuged and a further yield of plasma obtained which is drawn into tube *B*.

The next stage consists of clotting the plasma. This is brought about by the addition of a solution of calcium chloride of specific gravity 1022. The quantity of calcium choride to be added is determined by employing the following formula: the volume of oxalate in $\frac{a}{b} \times 1{\cdot}5 = x$ cubic centimetres to be neutralized.

Suppose 140 cubic centimetres of blood yield 80 cubic centimetres of plasma, then $\frac{80}{140} \times 1{\cdot}5 = 0{\cdot}85$ gives the figure for the oxalate.

One then refers to that figure in the oxalate column of the accompanying table for the amount of calcium chloride solution required. This is found to be 2·72 cubic centimetres in the example.

TABLE I.

Volume of 10% potassium oxalate solution.	Volume of $CaCl_2$ solution, sp. gr. 1·022.	Volume of 10% potassium oxalate solution.	Volume of $CaCl_2$ solution, sp. gr. 1·022.
c.cm.	c.cm.	c.cm.	c.cm.
0·50	1·6	0·77	2·464
0·51	1·632	0·78	2·496
0·52	1·664	0·79	2·528
0·53	1·696	0·80	2·56
0·54	1·728	0·81	2·592
0·55	1·76	0·82	2·624
0·56	1·792	0·83	2·656
0·57	1·824	0·84	2·688
0·58	1·86	0·85	2·72
0·59	1·892	0·86	2·752
0·60	1·924	0·87	2·784
0·61	1·96	0·88	2·816
0·62	1·992	0·89	2·848
0·63	2·024	0·90	2·88
0·64	2·056	0·91	2·912
0·65	2·088	0·92	2·944
0·66	2·12	0·93	2·976
0·67	2·152	0·94	3·008
0·68	2·184	0·95	3·040
0·69	2·216	0·96	3·072
0·70	2·248	0·97	3·104
0·71	2·28	0·98	3·136
0·72	2·312	0·99	3·168
0·73	2·344	1·00	3·2
0·74	2·368		
0·75	2·4		
0·76	2·432		

A clot quickly forms which after about an hour is in a suitable condition for further treatment. The clot is then gently separated by means of a sterile glass rod from the sides of the vessel to which it may be adherent. A brass weight illustrated in Figure III is then lowered gently on the top of the

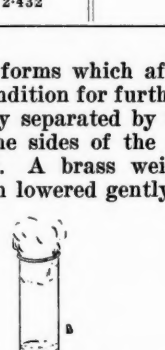

FIGURE III.

clot and the tube allowed to stand. The weight will gradually press down the clot, assisting in its contraction, so that the maximum of clear serum may be obtained free from clot.

The serum is then collected in a suitable container and pooled with other samples of serum classified in the same group. Filtration for sterility is effected by means of Pasteur-Chamberland *F* candles and subsequently bottled into ten or fifteen cubic centimetre ampoules, according to the group in which it is classified and tested for sterility.

The sera of groups 1 and 2 were bottled in ten cubic centimetre ampoules as being the best for intrathecal use; the sera of groups 3 and 4 into fifteen cubic centimetre ampoules.

No tricresol was added and nothing was done in the matter of typing the donors.

The total number of separate bleedings from donors was thirty-four and the total quantity of blood removed was 4·65 litres. From this amount 2·276 litres of plasma were obtained, equivalent to 48·9% of the total blood volume. From this quantity of plasma were obtained 1·789 litres of serum for use in the final bottled product or 38·2% of the volume of the total amount of blood removed.

Owing to the necessity of handling small quantities of blood, it must be remembered that losses due to handling are large,compared with those suffered in dealing with large volumes of blood, such as may be obtained from horses.

In conclusion I wish to acknowledge the work done by Mr. Morrell and other members of the staff at the Commonwealth Serum Laboratories in preparing this serum.

TREATMENT OF POLIOMYELITIS BY MEANS OF HUMAN IMMUNE SERUM.

By Jean Macnamara, M.D. (Melbourne),
Department of Public Health,
Melbourne.

A series of twelve cases of poliomyelitis is presented. To these twelve patients serum prepared by the Commonwealth Serum Laboratories from the blood of persons previously attacked by poliomyelitis was administered.

The number of patients is small for the reason that the incidence of the disease had declined by the time the serum was available and secondly that in many of the patients whose onset of illness occurred in the winter of 1925, the condition was not recognized and serum was not sought until paralysis had existed for several days. Although the numbers are far too small to justify any statement of the value of the serum as a means of therapy in this disease in which the prognosis in any given case is notoriously difficult, it is considered that the results are in accord with those obtained by Amoss and Chesney in a similar series of cases and that they justify further use of this method of therapy.

Short clinical notes of each case are appended, but the results may be dealt with briefly here. Before serum was given, lumbar puncture was performed and unless the fluid was mixed with blood, the cell content was estimated. This confirmation of the clinical diagnosis was regarded as being of great importance in the early stages, as a precaution against waste of serum.

The twelve cases may be divided into five groups, according to the stage at which serum was administered.

Group A.—In this division is only one patient who received serum in the pre-paralytic stage (Case 1.).

Group B.—In this group are two patients who received serum within twenty-four hours of the advent of paralysis.

Group C.—There is one patient who had a paralysis of the upper motor neurone type.

Group D.—This group comprises patients who received serum after paralysis had been present for a period of from thirty to fifty hours and who received it then because fever, hyperæsthesia and continued illness made the further spread of paralysis possible (Cases 5, 6 , 7, 8 and 9.).

Group E.—This group is represented by three patients to whom serum was given in the attempt to save them from death due to respiratory paralysis (Cases 10, 11 and 12.).

The four children of Groups A, B and C, that is, the first four patients reported, recovered completely. Repeated examinations have been made of these children and they have escaped any residual paralysis. This was expected in the first, pre-paralytic stage, but was much better than we expected in S.D. who had wide-spread loss of power in three limbs for twenty-four hours before she received serum. G.W. had an upper motor neurone lesion and while his recovery was dramatic, it is recognized that patients with this type of affection have a greater tendency to spontaneous recovery than those with the more usual lower motor neurone type.

Of the patients of Group D who were paralysed when serum was given, in no instance was further progress of paralysis observed, although in three instances (Cases 5, 6 and 7) the gradual spread before administration, fever and hyperæsthesia had led us to expect an extension.

Four of the five children in this group have had good return of power. It is impossible to decide how much of this should be attributed to the possibility of a limitation of the original damage after serum therapy and how much is due to the careful after treatment by rest and muscle reeducation. In most cases the mothers' pride and interest in their "serum treated" babies has resulted in more regular and persistent attendance for treatment.

The three patients of Group E survived. In each instance paralysis had been present for some days and was spreading steadily. Two patients (Cases 11 and 12) presented the typical picture of impending respiratory paralysis when serum was given. The survival of J.H., was not expected, because of the grave and long continued interference with respiration, deglutition and cardiac innervation. In these three patients the residual paralysis has been widespread, but good recovery is still occurring in A.P. and J.H.

The average quantity of serum administered was 52 cubic centimetres, the largest quantity of serum given intrathecally on one occasion was 30 cubic centimetres. In each case serum was given intravenously and subcutaneously, as well as intrathecally. Larger doses were used for patients treated later in the season, because more serum was then available, and secondly, it was thought that although stored on ice it would depreciate with lapse of time.

After administration of serum in each instance a careful watch was kept for the occurrence of any reaction comparable to that described by Draper as occurring after the administration intrathecally of serum to which tricresol had been added. No such reaction was observed. No patient developed a rash. In two the temperature rose to 39·5° C. (103° F.) for a few hours, but in every instance, considering the large quantities injected, the freedom from reaction was remarkable and justified all the care and effort of Dr. F. G. Morgan and the workers of the Commonwealth Serum Laboratories who prepared an aseptic product without the addition of any antiseptic. In three instances it was noticed for some weeks that the children disliked forward bending of the spine and it was suggested that this might be due to the intrathecal reaction to the foreign serum. This feature, however, even more marked and more persistent has been observed in many other patients who did not receive any such injection.

The freedom from any unpleasant reaction, the complete escape of our one patient treated in the pre-paralytic stage, the recovery without residual paralysis of the two children who received serum fairly soon after the advent of paralysis, the survival of A.P. and J.H., the arrest of paralysis at the stage of damage already done on the five children of Group D, while not justifying any extravagant claim, warrant at least a further use of this method of therapy, with the hope that in the future awakened interest must result in diagnosis at an earlier stage than at present, the pre-paralytic stage during which serum therapy should be more effective.

I desire to acknowledge my great indebtedness to the many members of the medical, nursing and massage professions, who helped so generously in the various stages of this work, particularly to the members of the honorary and resident medical staffs of the Children's, Alfred and Melbourne Hospitals for the opportunity of treating the children under their care, to the Director and members of the staff of the Walter and Eliza Hall Institute, to the members of the Advisory Committee, Drs. F. G. Morgan and R. Webster and to Dr. A. Jeffreys Wood, for advice on many technical and clinical difficulties and to Drs. W. Kent Hughes and T. W. Sinclair, the Chairman of the Metropolitan Committee, for the civic and financial administration which has made this work possible.

Case Records.

CASE 1.—T.J., male, aged five years, complained on March 7, 1926, of sore throat for one day.

At 9 o'clock in the morning of March 13 he complained of pain in the abdomen and in the legs particularly behind the knees. He stopped playing and looked flushed. At 9 o'clock in the evening he was admitted to hospital, the temperature being 37·8°C. (100°F.), the pulse rate 136 per minute. He was irritable, resenting examination and there was tenderness on pressure over the right hamstring muscles. Neck stiffness was present. The spine sign was elicited. The right knee jerk could not be obtained. Lumbar puncture was done, forty-five cubic centimetres of clear fluid being removed. Two hundred lymphocytes were present per cubic millimetre. Serum was given as follows: Twenty cubic centimetres of Group 1 serum were given intrathecally and twenty cubic centimetres of Group 3 serum intravenously. On March 14 the temperature was 38·1°C. (100·6° F.). The right knee jerk was still absent. On March 15 the temperature was normal, the child was still very irritable. Lumbar puncture was repeated and twelve cubic centimetres of Group 4 serum were given intrathecally. On March 28 the patient was discharged to the convalescent cottage. No paralysis could then be detected.

At examinations made on June 4, 1926, and November 15, 1926, no evidence of any paralysis could be detected.

CASE 2.—S.D., female, aged eighteen months, was noticed to be eating very poorly on February 1, 1926. On the following day she still seemed to be "off colour" and her mother noticed that she tended to fall over. On February 4 she became feverish and restless and resented handling. Pain in the back of the neck was noted that evening and it seemed to continue. On February 5 loss of movement not quite complete was noticed in both lower limbs and during the day the left upper limb seemed to become involved. The child was very irritable and sweated profusely. On February 6 serum was asked for at the suggestion of Dr. A. Jeffreys Wood who saw the child during the night of February 5, 1926. Her temperature was then 38·2°C. (100·8° F.). The child was lying quietly unless approached, when she whimpered and tried to resist handling. The spine sign was evident. Very sluggish movements at the hips could be obtained by painful stimuli. The abdominal muscles were paresed, the superficial reflexes lost. The deltoid on the left side was paralysed and other movements of the left arm very weak. Lumbar puncture was performed. The cerebro-spinal fluid was clear, under increased pressure and contained 250 mononuclear cells per cubic millimetre. Globulin was slightly increased. Serum was given as follows: Fifteen cubic centimetres of Group 1 serum were given intrathecally and twenty cubic centimetres, five of Group 1 and fifteen of Group 4 were given subcutaneously.

Her temperature that evening was 38·9°C. (102° F.). It subsided quickly. Power gradually returned. She was kept at rest in splints which had been promptly applied on February 6, for five weeks. For several weeks she resented forward bending of the spine. An examination made six weeks after the onset revealed only slight weakness of the abdominal muscles.

On June 1, 1926, no paralysis could be detected. On November 11, 1926, she was examined again. Recovery has been complete.

In view of the widespread distribution of her loss of power when serum was administered, her recovery was the most unexpected of the series.

CASE 3.—L.L., male, aged two years and ten months, seemed feverish and miserable for one day on February 28, 1926. On March 1 he seemed to be quite better and played about. On March 2, he again became listless and feverish. On March 3 loss of power was noticed in the right arm. He could not lift it above his head. He complained of pains in the back and had retention of urine. He was admitted to hospital, very irritable, resenting any examination. The spine sign was present. The left lower limb was hyperæsthetic and flexion at the hip weaker than the corresponding movement on the right side. He could not abduct the right arm. Lumbar puncture was performed. The cerebro-spinal fluid was very faintly opalescent and a coagulum formed on standing. The residual fluid contained twenty mononuclear cells per cubic millimetre. Globulin was slightly increased. Serum was administered as follows: Ten cubic centimetres of Group 1 serum and fifteen cubic centimetres of Group 3 serum were given intrathecally and fifteen cubic centimetres of Group 4 serum were given intravenously. On March 5, paresis of the hip flexors was less

evident. Irritability and neck stiffness had increased. On March 7 a gradual improvement had occurred. On April 5 the power of the thigh muscles had returned. He still resented forward bending of the spine. The arm had been kept splinted in the position of shoulder abduction. By May 24, 1926, recovery in the muscles of the thigh had been complete, in the deltoid almost complete. On November 15, 1926, no evidence of paralysis in any muscle could be demonstrated.

This boy was given serum soon after paralysis was noticed. No further progress of the paralysis occurred and with rest and muscle reeducation, the slight degree of paralysis sustained at the time when serum was given cleared up.

Case 4.—G.W., male, aged nine years, refused his evening meal on July 13, 1925, and complained of pain over the right side of his forehead. At midnight he became convulsed and later it was noticed that he could not use his right arm and right leg. On July 14 he was admitted to hospital, the temperature being 38·3°C. (101° F.) and the pulse rate 116 per minute. He was quiet and still unless disturbed. The right side of the face and the right lower limb were paresed, the right arm paralysed. All reflexes on the left side were present; on the right the plantar reflex gave an extensor response, the deep reflexes were absent. Lumbar puncture was performed. Twenty cubic centimetres of clear cerebro-spinal fluid were removed and examination revealed an increase of lymphocytes. The exact number was not recorded. On July 16 the temperature was 38·3°C. (101° F.). His condition was the same, except that he could be more easily aroused. Lumbar puncture was repeated. The lymphocytes in the fluid numbered thirty to forty per cubic millimetre.

Serum was administered as follows: Fifteen cubic centimetres of Group 1 serum were given intrathecally and five cubic centimetres intravenously. On July 17 the temperature was 36·4°C. (97·6° F.). The movement of the arm was much better. On July 18, fifteen cubic centimetres of Group 3 serum and 10 cubic centimetres of Group 2 serum were given intrathecally. On July 19 the temperature was normal. A gradual improvement had occurred. On July 31, he was discharged from hospital, apparently quite well.

He has been examined with care on four occasions since. No weakness was detected.

In this case the fact that his paralysis was of the upper neurone type, with a greater tendency to spontaneous recovery, detracts from the dramatic nature of his recovery.

Case 5.—J.R., male, aged five years and eight months, complained of headache on April 25, 1926. On the following day he was lethargic and feverish. On attempting to walk on April 27 the right leg "gave way." He was feverish, and complained of pain in the head and back. On April 28 definite loss of power in right leg was noted. On April 29 he was very irritable, complaining of severe pains in the leg and back. He was taken to hospital. On April 30 his temperature was 38·2°C. (100·8° F.). He was very irritable and complained of pains in the legs and in the right arm. Hyperæsthesia of these limbs and the spine sign were noted. He was unable to flex or rotate the right thigh at the hip or to straighten the right knee. The knee jerks and superficial abdominal reflexes were absent. Lumbar puncture was done. The pressure of the cerebro-spinal fluid was increased and the fluid clear. Globulin was increased and seventy-one lymphocytes were present per cubic millimetre. Serum was given as follows: Thirty cubic centimetres of Group 1 serum were given intravenously and ten cubic centimetres subcutaneously. A double Thomas's splint was fitted, with an arm piece to allow of abduction of the arm at the shoulder. On May 1, 1926, twenty cubic centimetres of Group 1 serum were given intravenously and ten cubic centimetres subcutaneously. The temperature subsided. No further spread of paralysis occurred.

On November 15, 1926, it was found that recovery in the arm had been complete. In the leg very good recovery had occurred, complete in the left quadriceps. There was still slight loss of power in the outward rotators of the hip and in the abdominal muscles. He was able to walk well without support, although he was not encouraged to do so.

Case 6.—N.D., male, aged four years and six months, complained of sore throat on May 3, 1926. On May 8 he became feverish and complained of headache and pains in the neck. These symptoms with delirium, pain on moving the head continued. On May 10 loss of power in the left arm was noted. On May 13 he was feverish, complaining of pain in the left side of the abdomen and in the left leg. He was admitted to hospital. The temperature was 38·1°C. (100·6° F.). The child was very irritable, resenting disturbance. The spine sign was present. Both upper limbs were hyperæsthetic. In the right arm power was lost in the triceps, weakened in the deltoid. In the left arm the scapular muscles, the abductors of the shoulder, the triceps and small muscles of the hand were paralysed. Clear fluid was removed by lumbar puncture. There was slight increase in globulin; the fluid contained forty lymphocytes per cubic millimetre. Serum was given as follows: Thirty cubic centimetres of Group 1 serum were given intrathecally and twenty-five cubic centimetres of Group 1 serum were given intravenously. Splints were applied. On May 14 the fever subsided. No further paralysis developed. On May 20 power gradually returned. By November 15, 1926, there had been a good return of power in the right arm, though not complete in the triceps. In the left arm, the triceps and the short muscles of the hand had not recovered completely. The arm could be abducted when the child was recumbent, but not against gravity. The rhomboids and the *serratus anterior* were still weak.

Serum was given to this patient three days after paralysis had developed. It was administered then because the process seemed to be spreading. No more impairment occurred, but the end result to date is only fair.

Case 7.—R.M., male, aged one year and eight months, was noticed to be restless, irritable and vomiting on October 19, 1925. Loss of power in the right lower limb was noticed on October 20. On October 21 the temperature was 38·3°C. (101° F.) on admission to hospital. The child was very irritable, with photophobia, and hyperæsthesia of the right lower limb and the right side of the abdomen. The knee jerks and ankle jerks were absent on the right side, but present on the left. The spine sign was present. The cerebro-spinal fluid was under increased pressure and clear. It contained an excess of globulin and forty mononuclear cells per cubic millimetre. Serum was given as follows: Twelve cubic centimetres of Group 1 serum were given intrathecally; eight cubic centimetres of Group 1 serum were given intravenously and twenty-five cubic centimetres subcutaneously. The temperature that evening was 39·8°C. (103·6° F.). On October 22 twenty cubic centimetres of Group 1 serum were given subcutaneously. The temperature fell to 37·8° C. (100° F.). On October 30 the temperature became normal and the irritability slowly decreased. *Herpes zoster* developed during his convalescence. On November 12, 1926, it was found that a fairly good recovery had occurred in all the muscles of the limb. Growth and vasomotor activity were good. The *gluteus maximus* and the hamstring were still weak, but if improvement continued a little longer, he would probably be able to walk well without support.

This patient received serum too late to save the limb. His photophobia and hyperæsthesia was severer than in any other child in the series. He had a rise in temperature after receiving forty-five cubic centimetres of serum.

Case 8.—A.McC., female, aged three years, had tonsillectomy performed on October 1, 1925. On October 8 she became feverish and irritable during the day and the mother noticed that she did not move the right arm during the night. On October 10 her temperature was 38·8°C. (101·8° F.) and pulse rate 144. The child was flushed and drowsy. The spine sign was present but not extreme. Loss of power had occurred in the movements of the right shoulder, right elbow and in the extension of the wrist and fingers of the right hand. The cerebro-spinal fluid was under increased pressure and fifteen mononuclear cells were counted per cubic millimetre. Serum was given as follows: Fifteen cubic centimetres of Group 1 serum, ten

cubic centimetres of Group 2 serum were given intrathecally and fifteen cubic centimetres of Group 3 serum were given intravenously. No rise in temperature occurred on October 11 and no reaction. Paralysis did not develope any further.

On November 12 she left the hospital. On November 9, 1926, it was ascertained that during the past year the arm had been carefully splinted to rest the weaker muscles and muscle reeducation had been faithfully carried out. There had been almost complete recovery of the movements of shoulder and elbow, but there was still definite weakness of the small muscles, particularly the *opponens pollicis* and the *lumbricales*.

This patient received serum too late. The damage had been done and the return of power is no more than usually occurs with careful after treatment.

CASE 9.—J.M., male, aged one year and eight months, fell over on November 15, 1925, and became drowsy and unhappy; he vomited once. Loss of power of the left arm was noticed on November 16. On November 17 the temperature was 38·5°C. (101·4° F.). No movements could be elicited at the left shoulder. The movements of the fingers were fair; of the elbow present but weak. The tendon jerks of the left arm were not obtained. The spine sign was present, but not very strong. The cerebro-spinal fluid obtained was unfortunately blood-stained. Serum was given as follows: Fifteen cubic centimetres of Group 1 serum were given intrathecally and twenty-two cubic centimetres of Group 3 serum were given intramuscularly. On November 18 the temperature was 38·9°C. (102° F.). The child was sweating and irritable. Ptosis of the left eyelid was noticed for some hours. On November 20 the temperature was normal; the child was much more cheerful. On December 5 he left the hospital.

Slight recovery had occurred by February 10, 1926, in the movements of the wrist, fingers and elbow, but very little at the shoulder. On November 11, 1926, it was found that he had not had regular treatment and the muscle recovery had been handicapped by the tendency to stiffness in the joints. The result in this case was poor, the child's age and temperament rendering his after treatment difficult. Serum was given late. No further increase of paralysis occurred after the administration, but the damage had been done.

CASE 10.—A.P., male, aged nine years and seven months, was noticed to be "off colour" and miserable on October 30, 1925. He came home from school on November 6 looking pale, went to bed and became feverish.

On the following day he complained of severe pain in the left scapular region. On November 9 he lost the power of movement of the left arm and on November 10 he complained of severe irritation in the left lower limb, followed later in the day by loss of power. On November 12 loss of power in the right lower limb occurred in the morning. He was drowsy; his temperature was 38° C. (100° F.). He had retention of urine and a definite spine sign. No movement could be elicited from the left upper or lower limbs. There was a patchy impairment of movement of both right limbs, there being loss of outward rotation and abduction of the shoulder and extension of the elbow, while all movements of the hip and knee were very weak. The specimen of cerebro-spinal fluid obtained was unfortunately mixed with blood. Serum was given as follows: Fifteen cubic centimetres of Group 3 serum were given intrathecally and fifteen cubic centimetres of Group 3 serum were given intravenously.

Retention of urine was no longer present on November 14. On November 16 he was still very irritable. No further development of paralysis was noted. On November 19 he was febrile.

It was ascertained on November 20, 1926, that the return of power had been good in all the limbs during the past twelve months, in which he had had rest and regular muscle reeducation. On the right side power in all muscles was almost normal, while the muscles of the back and left limbs were improving steadily. For example, the deltoid could easily abduct the shoulder when he was recumbent, but could not act against gravity.

It is not considered that any part of this improvement is due to serum administration. Serum was given to the boy because of the previous history of gradual spread of paralysis. No further advance of paralysis was detected.

CASE 11.—J.R., female, aged thirteen years, became feverish and complained of pains in the limbs on March 13, 1926.

On the next day she seemed to be better, but continued to rest. On March 15 the movement of both arms was lost. On March 17 she was brought to Melbourne and was seen at 9 o'clock in the evening. She was then very flushed, anxious, breathing with deliberation, answering questions with short abrupt answers, sparing words, resenting any disturbance which called for any additional effort. The spine sign was strong. In the right upper limb loss of power was complete except for movement of the hand and a weak action of the biceps. The left upper limb had more elbow movement, but very little at the shoulder. The intercostal muscles were acting. There was very little diaphragmatic movement. Both lower limbs were hyperæsthetic, but the power in the left was good, in the right there was a paresis of the quadriceps and the adductors. The cerebro-spinal fluid was under greatly increased pressure and clear and contained an excess of globulin and ninety mononuclear cells per cubic millimetre. Because of her respiratory difficulty, it was decided to administer serum only intravenously and intramuscularly, as it was feared that very little extra congestion of the cord would precipitate death from respiratory paralysis. Twelve cubic centimetres of Group 1 serum were given intravenously and thirty-three cubic centimetres of Group 1 intramuscularly. On March 18 her respiration was much easier.

No subsequent examination has been possible, but the involvement of the lower limb does not prevent her walking without the use of any support. Serum was given to her, solely in the hope that it might help to tide her past the threatening respiratory embarrassment.

CASE 12.—J.H., male, aged fifteen years, became feverish and vomited on October 19, 1926, but attributed his illness to a "bilious attack" to which he had been subject at intervals during the past few years.

On October 21 he complained of headache and backache and on attempting to arise, he found that he could not stand or walk. On October 22 definite loss of power in both lower limbs was evident. On the following day swallowing became difficult, at first intermittently; later each attempt to swallow produced great respiratory distress, in which he tried to cough.

On October 24 he complained of tingling in the arms and severe pains in the legs, with gradual loss of power in the left arm the deltoid hand muscles and the biceps. This pain continued throughout October 25 and October 26; his swallowing and breathing became more difficult than at any time previously. He had been afebrile after the first few days, but his pulse rate varied widely. For periods it would be regular at between 80 and 90 and then suddenly it increased to between 140 and 150 beats per minute. The spine sign was very strong; any attempt to move him at all being very painful. He was keenly alert throughout, reporting each further loss of power in the arms and hands as he discovered it. Examination revealed loss of power in all four limbs, not complete, however, in any. In the right arm the deltoid was paralysed, and in both the small muscles of the hands were not acting. His pain and hyperæsthesia prevented detailed examination of the lower limbs, but in both there was gross impairment of the movements of the hips and knees, particularly of flexion and extension of the hip and flexion and extension of the knees. The intercostal muscles and accessory muscles of respiration were acting well; the diaphragm scarcely at all. Lumbar puncture was performed. Unfortunately, the fluid was admixed with blood and a cell count could not be made. Serum was given as follows: Ten cubic centimetres of Group 1 serum were given intrathecally, forty cubic centimetres were given intravenously and twenty cubic centimetres were given intramuscularly. On October 27 fifty cubic centimetres of Group 1 serum were given intramuscularly. On October 28 there was great respiratory embarrassment for a few hours and distress from inability to swallow any mucus or saliva which had to be wiped away from the mouth continually. The pulse rate was very rapid and irregular. From October 23 until November 8

he was unable to swallow any fluids, rectal feeding being carried out throughout this period. On November 8 he swallowed a little fluid and then control over deglutition returned fairly rapidly. By December 8, 1926, he had regained the condition lost during the weeks of starvation. Breathing and swallowing had been easy for some weeks. There had been an excellent return of power in the muscles of both upper limbs and in the lower, recovery was already good, except for the flexors and extensors of both hips and the knee flexors.

In view of the very widespread nature of his paralysis, its tendency to progress and the very serious interference with the circulation, respiration and deglutition, his survival was not expected. No dramatic relief occurred after the administration of serum, but no further paralysis developed and with splendid care he was tided over until he became able to swallow again.

My thanks are due to Dr. Donald Pryde, of Warragul, for permission to include the history of this patient's illness in the series and to his enthusiastic care and treatment the boy's survival must be attributed.

Dr. E. H. M. Stephen (Sydney) said that his experience with cases of infantile paralysis and their treatment with serum was limited. The first child had had fever and signs of paralysis. Serum had been given intrathecally and intramuscularly and the child had recovered in a week. All the other patients had been in the paralytic stage before serum had been administered and these children had not shown any improvement. All the serum collected in Sydney had been obtained from young children.

Dr. A. B. Pearson (Christchurch) said that during the epidemic of infantile paralysis in New Zealand the wave showed a decreasing incidence from the north to the south. The infections, however, in the south were equally severe. There were many cases, undiagnosed, of vague illness which must have been anterior poliomyelitis. Lumbar puncture had been carried out in only a few instances. The examination of the cerebro-spinal fluid was a great help in diagnosis. The point raised by Dr. Tebbutt in regard to distinguishing between tuberculous meningitis and infantile paralysis had also been raised. The sugar content of the cerebro-spinal fluid was a great help. In anterior poliomyelitis there was generally no alteration, while in tuberculous meningitis it was always lower.

Convalescent serum had been used for treatment in doses of from ten to fifteen cubic centimetres. In the preparalytic condition with a high cell count the results were dramatic. In the fulminating infections nothing seemed to do any good. Serum had at first been given intrathecally, but later had been injected intravenously and intramuscularly. At the *post mortem* examination on some patients who had had intrathecal injection, he had noticed a gelatinous exudate which was extradural. He had thought that this was due to injection, but later had proved that this was not the case. There was often complete disorganization throughout the whole length of the cord. In fulminating infections the lesions were largely confined to the brain; these patients died with symptoms of acute bulbar paralysis. Until a few hours before death the children were quite well.

Dr. P. P. Lynch (Dunedin) said that he was pleased to hear Dr. Macnamara emphasize the importance of the examination of the cerebro-spinal fluid. In Wellington in 1925 many differences in clinical signs were noted among the first group of patients. Three to four weeks before it had been recognized that the patients were suffering from infantile paralysis, there had been much vague sickness amongst the school children in Wellington. Considerable help had been gained from the cerebro-spinal fluid. There was always evidence of inflammatory reaction. Great care had to be exercised in the interpretation of results. In some patients there was a high cell count and a turbid fluid and there was some doubt as to whether these were suffering from infantile paralysis or meningococcal or other coccal infection. The development of paralysis settled the diagnosis. Towards the latter end of the epidemic there had been the same variation. If there was any inflammatory reaction at all, serum had been given. One hundred to one hundred and fifty children had been treated by serum in Wellington and Dr. Robertson who had carried out a great deal of this work, had had no doubt whatever of the value of serum in treatment.

Dr. E. B. Durie (Sydney) said that she would be interested to hear something about the collection of serum in New Zealand, since there had been more children infected with infantile paralysis during recent times in New Zealand than in New South Wales.

Dr. A. H. Tebbutt (Sydney) asked Dr. Macnamara how she satisfied herself that the fluid withdrawn before serum was given was from a patient with anterior poliomyelitis. He was glad that Dr. Pearson had mentioned the value of the sugar content in diagnosis. Woodhill in Sydney thought that this was an important factor and stated that it was either reduced or absent in tuberculous meningitis. With regard to the exudate found after intrathecal injection he said that aseptic meningitis from injection of horse serum was known, but he know of no cases from injection of human serum.

Dr. Jean Macnamara replied that she had tried to prove that each patient had been suffering from anterior poliomyelitis in the preparalytic stage before serum had been given. When she went to see a patient, she went prepared to do a lumbar puncture; she took a microscope and counting chamber and the necessary reagents. The child was first examined to determine the advisability of lumbar puncture. She thought that lumbar puncture was only justified when there was definite evidence of meningeal invasion—dislike of anterior flexion of the spine and restlessness. If these symptoms were present, a few drops of fluid were withdrawn and the obturator replaced in the needle. These few drops were examined immediately according to Draper's technique. Later a more careful examination of the fluid was made. There had been a history of whooping cough and sickness for some time before in four children; she had therefore refused to use serum and was quite justified in doing so as no paralysis developed. If the examination of the fluid yielded evidence of infantile paralysis, serum was given immediately.

She agreed with Dr. Stephen that the value of serum given after paralysis had set in was doubtful. She showed photographs of the child mentioned by Dr. Jeffreys Wood.

SPECIFIC LOCALIZATION OF STREPTOCOCCI.

By C. H. Kellaway, M.C., M.D., M.S., M.R.C.P.

AND

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In recent years Rosenow (1919) has put forward the view that individual strains of streptococci may acquire affinities for particular tissues and that arthritis, gastric ulcer, endocarditis and a number of other conditions may be caused by streptococci which multiply in infected foci from whence they reach the blood and settle in those tissues for which they have a predilection. As evidence of the truth of this proposition there are presented numerous experiments in which cultures of mixed organisms from foci of infection are injected intravenously into rabbits and cause acute though often evanescent lesions in organs analogous to those in which pathological lesions are present in the patient from whom the cultures were obtained.

The experiments recorded in this paper are not offered in support of the doctrine of focal infection more particularly, since cultures from infected foci in otherwise normal individuals can produce similar lesions in laboratory animals [Moody (1916)] and it is evident that rigid proof of Rosenow's conception could only be obtained by the production of lesions of the joints or other organs by setting up chronic

experimental foci of infection elsewhere in the body. This Rosenow and Meissen have succeeded in doing in dogs.

Rosenow (1923) also claims in some cases to have altered the cultural characters and the specific localizing tendency of streptococci by repeated animal passage and the present communication is concerned with this aspect of his work. Suitable organisms for study have been isolated from a number of patients with arthritis and of nephritis in which on clinical grounds focal infection of the teeth or tonsils appeared to play some part.

Methods.

Cultures were taken from the suspected foci into glucose-brain broth. From the teeth these were inoculated with material from the apex after extraction and from the tonsils with pus obtained from the depths of the crypts. After twenty-four hours' incubation they were plated out on blood agar (0·5 cubic centimetre of fresh horse blood to each plate). The plates were incubated for twenty-four hours aerobically and anaerobically, though later anaerobic cultures were discontinued as they were found to present no advantage. As many colonies of streptococci as could be differentiated by their appearances after twenty-four and forty-eight hours' incubation were picked off and inoculated on to blood agar slopes. The supernatant fluid of the original brain broth culture after twenty-four or forty-eight hours' incubation was pipetted off and injected in varying doses into the ear veins of rabbits of from one to two kilograms in weight. The animals were killed usually on the fifth day and carefully examined with aseptic precautions, cultures in brain-broth being taken from any obvious lesions and from the heart blood into one hundred cubic centimetres of hormone broth. The transverse tarsal, ankle, knee, hip, wrist, elbow and shoulder joints were opened with the cautery and frequently also the metacarpo- and metatarso-phalangeal joints. The mucous membrane of the mouth, stomach and appendix, the sciatic nerves, the skeletal musculature and the intrathoracic and abdominal viscera were carefully examined in every animal. Cultures from lesions in the solid viscera were obtained by placing in the culture tubes pieces of tissue cut out with sterile instruments after searing the surface of the organ with the cautery. In almost all cases the organisms which grew, were in pure culture.

The streptococci isolated were subcultured monthly on to blood-agar slopes which were kept in the dark at 3° C. after incubation for twenty-four hours at 37° C.. These were tested for their fermentation reactions on lactose, mannite, salicin, inulin and raffinose both when freshly isolated and after many subcultures. Organisms recovered from passage were always tested for their fermentation and other cultural reactions after again plating them out to insure their purity. All injections into laboratory animals were given intravenously. To obtain a more accurate dosage when pure cultures were used the organisms were usually counted after diluting with saline solution (1 in 100 or 1 in 200), a blood counting chamber, a bright source of illumination, a fully stopped down iris diaphragm, a 20 millimetre or 40 millimetre objective, and a "× 20" eyepiece being used. The counts were fairly consistent if sufficient time were allowed (at least half an hour) for the organisms to settle. In a few cases enumeration of streptococci was impossible owing to spontaneous clumping.

Experimental Work.

Fifteen cases of arthritis and seven cases of nephritis were investigated. The cultures taken from the teeth or tonsils of the patients were injected into varying numbers of rabbits. The average dose in the arthritic series of cases was somewhat lower than in the nephritic. In the first, eleven animals received one cubic centimetre, seven two cubic centimetres, five three cubic centimetres, twenty-six four cubic centimetres, three five cubic centimetres and two seven and nine cubic centimetres respectively. In the nephritic series four received three cubic centimetres, eleven four cubic centimetres, eight five cubic centimetres, five six cubic centimetres and two seven and nine cubic centimetres respectively. A comparison of the results in these two series is in general accord with the findings of Rosenow and of many others who have applied his method.

TABLE I.

ARTHRITIS.

Number of rabbits	54
Number with joint lesions	30
Pus in joints	14
Increased synovial fluid	12
Hæmorrhage or œdema around joints	4
Number with kidney lesions	9
Number in which streptococci isolated from joints	12

NEPHRITIS.

Number of rabbits	30
Number with kidney lesions	12
Pyelo-nephritis	4
Cloudy swelling	3
Hæmorrhage in kidneys	5
Number with joint lesions	5
Number in which streptococci isolated from kidney	3

Among the animals injected with cultures from cases of arthritis, in five lesions apart from those due to coccidiosis were found in the liver, in five there were hæmorrhages in the mucous membrane of the stomach, in one there was a lung infarct, in two there were hæmorrhages in the sciatic nerves and in three there were small hæmorrhages in muscles other than those in the neighbourhood of infected joints. Among the animals injected with cultures from cases of nephritis, in two there was infective endocarditis, in two meningitis, in one an ulcer and in one a small hæmorrhage in the mucosa of the stomach and in two infarcts of the lung.

The blood was sterile in all cases recorded in the table as yielding organisms by culture of the kidneys or joints. In three animals of the arthritic series and in five of the nephritic series streptococci

were isolated from the blood at autopsy and in several of these organisms were isolated from joints or kidneys with gross pathological changes. In a few cases organisms other than streptococci were obtained from lesions in the animals used. These included a *Staphylococcus albus* from a joint and a Gram-negative bacillus, a *Staphylococcus albus* and a diphtheroid either from kidney lesions or from the urine in the bladder.

There are certain obvious objections to the procedure adopted here and to any deductions which might be drawn from the results. In the first place no account is taken of the individual resistance of the animals to infection and more particularly of the possible variable susceptibility of their different tissues to bacterial injury. As far as general resistance is concerned young animals seem to be much more susceptible and the injection of pure cultures in many animals would be required to evaluate individual variations in tissue resistance. There are other uncontrollable variables under these experimental conditions; the pathogenic organism may not be the predominant one in the culture and the numbers in which it is present cannot be related to the size of the dose; the other organisms present are almost certainly different in every case and even if there were no such variation in the flora from the infected focus, variation in their numbers relative to each other and to the pathogenic organism if present would inevitably be found. It may also be urged that toxic substances present in the culture would vary with the flora and would not be without effect on the result, though Rosenow has avoided this by using cultures that have been centrifuged and resuspended in saline solution and in the present series of experiments the animals after injection did not seem to be immediately affected in any way even by large doses if these were given slowly. Apart from these objections to the procedure itself, it is evident that the streptococci isolated may not be themselves responsible for the production of the associated lesions, but may be secondary invaders derived from the injected culture or even from the alimentary tract or other source within the animal used. No evidence was obtained in any of these experiments of this last possibility and on the contrary most of the organisms isolated corresponded closely in cultural characters with organisms found in the original culture which was injected. That secondary invaders may at times be isolated is suggested by the results obtained by experiments with cultures taken from the same focus on a number of different occasions. This was possible through the kindness of Dr. S. V. Sewell

Table II.

Date.	Serial Number of Rabbits Injected.	Dose of Culture in c.cm.	Findings at Autopsy.
January 16, 1926	1	1	Hæmorrhages round right knee joint and in right sciatic nerve. Pin-point abscesses in both kidneys, infarct in right lung. Green streptococcus from the kidney and lung infarct.
February 3, 1926	2	2	Excess of fluid in the left shoulder joint, sterile.
	3	3	Increased fluid in both knee joints, hæmorrhage in right *tibialis anticus* tendon and below right knee joint.
	4	4	Excess of sterile synovia in right elbow joint.
	5	5	Pus in right knee and shoulder joints, hæmorrhages round the joints. An indifferent streptococcus which fermented lactose, salicin, inulin and raffinose was isolated. A similar streptococcus was also isolated from the original tonsillar culture.
March 4, 1926	6	4	Hæmorrhage in the right sciatic nerve. Increased fluid in left hip joint, pus in left knee and hæmorrhage into the left transverse tarsal joint. From the blood and from the knee joint a green streptococcus was isolated.
	7	4	Pus in the left knee joint, green streptococcus isolated.
	8	4	Pus in the right shoulder and ankle joints, from the ankle joint a Gram-negative bacillus was obtained.
	9	4	Polyarthritis with pus in all the joints green producing streptococcus identical in cultural characters with those from Rabbit 6 and Rabbit 7 and fermenting only lactose and raffinose was isolated. A similar streptococcus was also isolated from the tonsil culture.
April 13, 1926	10	4	A few petechiæ in the mucosa of the stomach.
	11	4	Nil.
	12	4	Nil.
	13	4	Turbid fluid in right knee, increased fluid in the right elbow and left hip joints. Hæmorrhage in gastric mucosa.
	14	4	Increased fluid in both hip joints.
	15	5	Increased fluid in right shoulder joint.
	16	3	Polyarthritis with pus in all joints. A green streptococcus fermenting only lactose and raffinose but not identical with that for Rabbit 9 above was isolated. A similar streptococcus was also isolated from the original tonsil culture. This was the only rabbit inoculated from this culture which contained a piece of excised tonsil.
	17	5	Increased fluid in the right knee joint.

who took cultures for me from the tonsils of a private patient with rheumatoid arthritis in whom nearly all the joints had become affected. In this patient who was forty-eight years of age, the history of the infection was of eight months' duration when the first culture was taken, all her teeth had been extracted prior to the onset of her illness and we were able to exclude most other possible foci of infection.

Table II is a brief summary of the results.

In this patient, three distinct strains of streptococci were found associated with joint lesions in rabbits and these after many subcultures have preserved their general cultural characters and fermentation reactions without change. Each of these organisms was identical in its cultural characters with a streptococcus isolated from the tonsil culture of the patient. Though it is obviously not possible to claim on these grounds that the strains isolated from lesions in the rabbit were identical with strains in the original culture from the patient, yet in view of the infrequency of the occurrence of organisms other than streptococci in these experimental lesions it is more likely that they originated from the injected culture than from any other source. It is unlikely that all these streptococci were involved in the causation of arthritis in the patient. Alternatively, some of them may have been secondary invaders which were able to establish themselves in the joints of rabbits after they had been damaged by the activity of some other organism. If this were so, they ought not to be capable of causing similar lesions when injected into fresh animals. Unfortunately we tested this at once only with one of these three strains. The culture from Rabbit 16 (strain 7) was injected in a dose of five cubic centimetres into two rabbits both of which died in the course of forty-eight hours. In the rabbit which survived longest, the joints were injected and distended with fluid. A fresh twenty-four hour subculture was obtained from these joints and injected in a dose of two cubic centimetres into a third animal which when killed four days later had a purulent arthritis of the right transverse tarsal joint from which a streptococcus with cultural characteristics, identical with those of strain 7, was recovered.

There was much variation in the ability of organisms freshly isolated from rabbit lesions to cause similar lesions in further animal experiments. In some cases the results were negative, while in others not only were the freshly isolated streptococci able to produce such lesions but even did so when twenty-four hour subcultures in brain broth of organisms which had been repeatedly subcultured on blood agar, were used.

An example of this kind is afforded by a long chained green producing streptococcus (strain 11) which fermented lactose and salicin, but not mannite, inulin or raffinose. This was isolated from purulent joint lesions in three out of four rabbits injected with four cubic centimetres of a mixed culture from the tonsil of a case of acute arthritis. Three months after this organism was isolated five cubic centimetres of a twenty-four hour subculture in brain broth regularly caused acute suppurative polyarthritis in rabbits.

In the case of organisms in which pathogenicity for the rabbit had been lost by growth *in vitro*, it appeared possible to restore it by appropriate animal passage. An indifferent streptococcus (strain 19) with chains of medium length, which fermented lactose, salicin, inulin and raffinose, but not mannite, was isolated from the kidneys of five rabbits injected with five cubic centimetres of a culture obtained from the tonsils of a young man with recurrent nephritis.

In four rabbits there was gross pyelo-nephritis and the kidneys in the remaining animal were the seat of intense cloudy swelling. In this last and in another animal there was streptococcal meningitis in addition and in two others acute infective endocarditis was present with multiple pyogenic arthritis and lung infarction. During the first three months after isolation twenty-four hour subcultures of strain 19 caused no obvious local lesions when injected into seven rabbits, in doses ranging from 6,000 million to 15,000 million organisms, though two of these which received 10,000 and 15,000 million organisms respectively died within forty-eight hours.

Attempts to produce lesions with this strain by injecting it together with a mixed culture of the organisms originally isolated from the patient's tonsil, which included a hæmolytic streptococcus and two green producing strains, failed. When, however, subcultures of strain 19 in glucose-brain broth were injected into rabbits in which one ureter had been exposed in the flank under ether anæsthesia and damaged by clamping it momentarily, the organisms were almost invariably localized in the corresponding kidney causing gross purulent lesions even when small doses were used. Cultures from these infected kidneys in doses of the order of 1,000 million to 6,000 million organisms when injected intravenously into rabbits invariably caused bilateral pyelo-nephritis, from which the original strain 19, was recovered in pure culture.

At a later period it was not found possible to repeat these observations even when the strain was passed through the kidneys of five successive animals and it was noted that subcultures from blood-agar in some batches of glucose-brain broth instead of yielding a uniform turbidity gave a heavy white deposit of agglutinated streptococci. The colonies on blood-agar were much drier, more definitely mammillated and could be removed from the plate only with difficulty. From subcultures which had been obtained by passage, we were able to pick out typical smooth and rough colonies and by repeated selective plating from single colonies two variants, one rough and one smooth with the original fermentation reactions of 19, were isolated. The rough strain was non-pathogenic for rabbits even in doses as large as 15,000 million, while the smooth strain in small doses up to 6,000 million organisms gave lesions in the kidneys only, but in

larger doses produced various other lesions, notably polyarthritis. Similar rough and smooth variants were obtained from cultures of 19 which had never undergone passage since their original isolation. It was found difficult to maintain the pathogenicity of the smooth strain *in vitro*. When some of its virulence had been lost an attempt was made to restore it by passage, but with negative results. The rough strain was also unstable and readily became smooth when repeatedly subcultured in some batches of glucose-brain broth. This last phenomenon suggests the explanation of our earlier results as in addition to growth in the injured kidney for some days the experiments involved an additional subculture in brain-glucose broth, which may have allowed the smooth strain to become predominant. Some variation in the behaviour of the brain-broth was also noted in different batches, some being ideal for the development of the smooth and some for the development of the rough strain of 19.

Faber's (1915) experiments on arthritis in rabbits have suggested the importance of local sensitization or some similar process in producing susceptibility to second or third intravenous injections with streptococci of low virulence, which had failed to produce any effect following the first injection. Experiments were undertaken with strain 19, in which subcultures of the organism in brain-glucose broth and in kidney-brain-glucose broth were inoculated in three successive doses of two to two and a half cubic centimetres at intervals of fifteen and twelve days, the animals being killed on the fifth day after the last injection, but no susceptibility was produced.

It is interesting to note that strain 34 which was culturally identical with strain 19 and which was isolated directly from the original tonsillar culture of the nephritic patient whose rabbit experiments yielded strain 19, localized readily in the kidney of a rabbit damaged by clamping the ureter, but subcultures from this source failed to cause any gross lesions in three rabbits infected with 3,000 million, 6,000 million and 9,000 million streptococci, though in the case of the rabbit which received the largest dose, the organisms were recovered from both kidneys.

In all the passage experiments recorded here the organisms have been recovered in pure culture from the lesions and in no case has any change in their fermentation reaction been obtained even after passage through a series of animals.

From the experiments detailed in this preliminary communication, it seems clear that streptococci which when first isolated tend to localize specifically in rabbits may lose their pathogenicity under conditions of culture. In some cases this change is correlated with variation from smooth to rough forms and is not appreciably affected by passage. "Specific" localization of pathogenic organisms appears to depend to some extent on the size of the dose injected.

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Dr. K. R. Steenson (Dunedin) said that he had carried out research work on rheumatoid arthritis for eighteen months. Complement fixation to streptococci had been done to determine if the serum of patients suffering from rheumatoid arthritis gave a stronger fixation than normal serum. The work had been carried out on the lines described by Burnbank and Hadjapoulos. He had used the same methods, but had failed to make his results coincide with theirs. Complement fixation tests had been carried out with single strains of streptococci in an attempt to localize the source of infection. Whenever complement was fixed by one strain, he found that it was fixed by other strains owing to cross fixation.

Professor H. P. Pickerill (Dunedin) said he was interested in Rosenow's work. Dr. Kellaway gave the time between injection and killing of the animal as five days. He thought that Rosenow waited several weeks. It also seemed to him that rather large doses were given in comparison with the size of the animal. One to five cubic centimetres per kilogram body weight for a rabbit seemed to him too large a dose. He wondered whether it would be possible to give repeated small doses. He wished to know if Dr. Kellaway's work would be of any value in diagnosis. He thought the relationship between septic teeth and tonsils and rheumatoid arthritis was important.

He asked Dr. Kellaway if he would describe the method of collecting organisms from teeth and tonsils. He asked if Dr. Kellaway had proved that the teeth were obviously infected and what the type of lesion was. He thought that skiagrams of the infected teeth should be taken.

Dr. A. H. Tebbutt (Sydney) said that it was unfortunate that Dr. Kellaway's results did not point to bacterial evidence of focal infection. When asked to examine a septic focus and find the particular organism, the bacteriologists were unable to do so. Vaccines were prepared from all the organisms found. There seemed to be no way of isolating a definite strain.

Dr. Kellaway replied that Professor Pickerill's remarks were extremely interesting. With regard to the size of the dose he agreed with him that the doses given were too large, but the doses employed by him were those used by Rosenow. Rabbits could stand a large dose without any immediate effect and he thought that it was much better to give a large dose containing a small number of organisms than a small dose with a large number of organisms. He had attempted to carry out Professor Pickerill's suggestion by giving repeated small doses. The animals had become sensitive either to some protein or to the organisms and also susceptible to their effects. All he had succeeded in doing was to kill the animals. Faber showed that streptococci by themselves would not produce a joint lesion, but if the animal were first sensitized with a small dose and then a larger dose was given, joint lesions would be produced. He claimed that the changes in the tissues were of greater significance than the finding of the organisms. He had injected dead cultures into the knee joints of animals and had then given small doses intravenously and in all cases he had killed the animal.

With regard to the technique the organisms were usually collected from tonsils. There was no doubt concerning the association of acute tonsillitis with acute nephritis. On the other hand he was not prepared to say that the Rosenow type was an absolute criterion for diagnosis. Cultures were obtained from deep down in the tonsillar crypts. A good exposure was obtained with a tongue depressor; a blunt-ended silver probe was inserted straight into the crypts. It was essential to pass the

probe into the crypts to obtain pathogenic organisms. Two or three cultures were always taken. The same thing applied to teeth. If the teeth were extracted, it was difficult to avoid secondary infection. The method he used was to clean the outside of the teeth carefully and then to attempt to obtain a culture from the point of the apex. He did not actually obtain cultures from the root canal. He usually found that teeth with obvious chronic infection at the root gave cultures which contained only one or at the most two organisms.

Finally with regard to the diagnostic value he was very sceptical. He had endeavoured to carry out investigations in the same way as Rosenow had done in his experiments. Strains of streptococci were plated and tested against patients' freshly drawn blood. This was done in a number of cases, but no light had been thrown on the pathogenicity of the organisms isolated. He agreed that complement fixation was very difficult.

SECTION VII.—OTOLOGY, RHINOLOGY AND LARYNGOLOGY.

SOME OBSERVATIONS ON CHRONIC SPHENO-ETHMOIDITIS.

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Christchurch.

NASAL sinusitis is a comparatively modern subject of study. Today there are medical men all over the world doing fine research in connexion with diseases of the paranasal cells. Two names are outstanding in this respect, Logan Turner of Edinburgh, and Sluder of St. Louis.

The importance of spheno-ethmoiditis lies in the fact that the profession now recognizes that many unexplained diseases have their origin in hidden septic foci without the eradication of which it is impossible to cure the sufferers. Dental and pharyngeal sources have had their day and still hold the field; but, I think, in paranasal disease we have a greater cause of many systemic and local troubles.

I take it that what is meant by this title is posterior ethmoidal and sphenoidal disease. It is generally accepted that sphenoidal disease is rarely found without posterior ethmoidal affection and the converse is likewise true.

Before going into the question of the disease and its treatment it might be well to refer to some points of importance about the anatomy of the parts. Full descriptions of the anatomy may be found in the text-books, but these vary, especially in the American and English productions.

The ethmoid labyrinths are blocks of "honeycomb" cells slung beneath the anterior cerebral fossæ, joined together by the cribriform plate and roofed in by the frontal bone. They are separated from one another by a space varying from five to twenty millimetres or more and this space is divided vertically into two more or less equal chambers by the perpendicular plate of the ethmoid which is slung from the cribriform plate. Each labyrinth is divided into two portions by an oblique septum which is practically the outer part of the middle concha or turbinal. This septum penetrates the complete depth of the labyrinth and begins in front and above just behind the fronto-nasal duct or the infundibulum and passes downwards and backwards to end almost at the postero-inferior angle of the mass. Below and in front are the anterior cells; above and behind are the posterior cells. These groups, as a rule, have no connexion with one another, but in reality when there is purulent ethmoidal disease, the dividing plate is defective owing to erosion and the two groups are simultaneously affected. There is an exception to that where one or two isolated cells of the anterior group around the fronto-nasal duct are infected alone.

The posterior cells are said to be two in number, but there may be only one or from three to five. These are roofed in by the orbital plate of the frontal and the rest of the inner part of the horizontal plate of the frontal and sometimes by the sphenoid. Occasionally an ethmoid cell is found to extend to the external and superior aspect of the sphenoid. It is this cell which is difficult to get at and dangerous to attack, for it comes into close relation with the optic nerve and the nerves which pass through the sphenoidal fissure. Usually, the hindermost cell is closed in by the anterior wall of the sphenoid body. The ostia of these cells open into the superior meatus and, therefore, pus from them is found in the olfactory cleft or more likely by posterior rhinoscopy on the upper surface of the middle turbinal and on the lateral wall of the nasopharynx.

The sphenoidal cavity is said to be contained within the body of the sphenoid bone. There are two, separated by a dividing wall which is usually in the mid plane vertically and generally complete. But the variations are almost equal in number to the normal condition. Sometimes one cell may take up most of the area of the body and the other be found to be very small. Sometimes one overrides the other and may come into relationship with the optic nerve on the opposite side, an important point in the diagnosis of optic nerve complications.

Again, the sphenoidal cavity may extend down into the root of the internal pterygoid process and even far down into one or other of these processes. Hence the impossibility of curing some forms of sphenoidal suppuration. In such instances the sphenoidal cavity may surround the vidian nerve and this would explain the vidian neuralgia in suppuration. This neuralgia is evidenced by pain in the mastoid region, in the occiput halfway between the mastoid and inion and pain in the shoulder and even down to the fingers. Yet, again, the sphenoid cavity may extend far outwards into the lesser wing of the sphenoid and come into close relation with the upper division of the fifth nerve. In its downward extension, already mentioned, some say that it reaches even to the *foramen ovale* and therefore comes into relationship with the inferior division of the fifth. In this way a sphenoidal infection is said sometimes to affect all three branches of the fifth.

It is perhaps necessary to point out that Meckel's ganglion is intimately associated with the sphenoidal and ethmoidal air-cells as it lies in the spheno-

palatine recess at the inner end of the spheno-palatine foramen. Sluder's work on this subject is worth study: he seems to give a scientific explanation for many of the neuralgic and vasomotor symptoms hitherto classed as varieties of neuralgia or tic and pseudo-hay fever.

The mucous membrane is firmly bound to the periosteum. In the respiratory region it is covered with columnar ciliated epithelium interspersed with goblet or mucin cells. In the deeper layers are many acinous glands secreting a watery fluid. In children there is much adenoid tissue in this layer.

The olfactory region is covered with columnar non-ciliated epithelium among which are the olfactory cells. Embedded in this area are the tubular glands of Bowman.

The olfactory nerves have no medullary sheath. The nerve supply, apart from the olfactory nerves, consists of branches from Meckel's ganglion and the vidian and the nasal branch of the ophthalmic nerve.

The floor and anterior part of the inferior meatus are supplied by the nasal branch of the superior dental nerve. The arteries are the spheno-palatine from the internal maxillary, the lateral nasal branch of the facial, a branch from the superior coronary and the ethmoidal branches of the ophthalmic artery.

The veins pass forward to the facial, backwards to the spheno-palatine and upwards and outwards *viâ* the ethmoidal veins to the ophthalmic veins. Sometimes there is a communication through the cribriform plate with the superior longitudinal sinus.

In the *Journal of Laryngology* of November, 1926, Logan Turner has a very excellent article on "Paths of Infection to the Brain." He cites a case of post-operative purulent pneumococcal leptomeningitis where microscopic examination of the tissues demonstrated that the lymphatic sheaths of the olfactory nerves were the paths along which the infection spread. A fracture of the frontal bone roofing in the cells which had been removed, showed no signs of spread of infection in that area.

Writing of the lymphatics of the nasal mucous membrane, he says:

> The general direction of the lymph flow is in an antero-posterior direction. In the most anterior part of the nasal mucosa the collecting trunks pass forwards and join the cutaneous lymphatics of the vestibule, the external nose and the cheek, the efferents eventually reach the deep cervical glands. The main lymphatic stream is directed backwards into the pharynx. Some of these vessels course laterally and downwards along with the lymphatics of the soft palate and tonsil and pass with the pharyngeal lymphatics to the superior deep cervical glands. Others enter the retropharyngeal glands. From the olfactory area the lymphatic trunks are directed backwards to the choana. But there are perineural lymph spaces surrounding the olfactory nerves. By injecting the pia-arachnoid spaces in animals, it was possible to fill the perineural lymph spaces in the olfactory mucosa. Apart from the olfactory perineural lymph spaces there is no direct communication between the sub-arachnoid space and the lymphatics of the nasal mucosa.

In the case cited Turner says that the perineural lymphatic sheaths were infiltrated by pus and that infection of the leptomeninges took place by this route. The olfactory lymphatic spaces were opened during the operation and the chronic infection present in the nose spread to them.

I had an interesting case partly illustrative of this. A young man, about twenty-six, who had an accident to his face, had been to see me some years before and had been told that he needed a submucous resection to drain the ethmoid area on the right side. I was sent for to the country because he was delirious following a knock-out at a boxing match. I saw him two and a half days after the accident and found him in a state of delirium with a temperature of 38·9° C. (102° F.). The local doctor took off cerebro-spinal fluid in my presence and it was found to be opalescent. The same day it was examined by a bacteriologist (the late Dr. A. Foster), who said that there were numerous pneumococci in it. Later he told me that there was a pure growth of pneumococcus in the specimen. The following day I cleared out the right ethmoidal area under a general anæsthetic and gave him pneumococcal vaccine daily. This man gradually got well. He might have got well without operation. In my opinion he had a fracture of the anterior fossa of the skull and the olfactory perineural spaces were torn and infected from the chronic ethmoiditis.

Taking the two areas together, as the title does, I have divided chronic diseases into two classes: (i) The catarrhal or non-suppurative type which Sluder calls hyperplastic spheno-ethmoiditis, (ii) suppurative spheno-ethmoiditis, with or without complications. The latter I divide into: (*a*) latent, without visible signs, (*b*) manifest, with visible signs, (*c*) closed.

There is great confusion in the books about this classification.

Catarrhal or Hyperplastic Spheno-Ethmoiditis.

Catarrhal spheno-ethmoiditis is a low-grade inflammation; pathologists state that the surface epithelium is unaltered, but that there is exaggerated round-celled infiltration with great deposit of fibrous tissue in the deeper layers. The glands are said to be altered in character; they may be hypertrophied, but they secrete thickened and altered mucus. This may be due to constriction of the blood-vessels, arteries and veins. The amount of secretion is small and it gives the mucosa a shiny and wet appearance. In old-standing cases thin crusts may appear, but I think that these are caused by the deposition of dust amidst the mucus. These crusts are often seen on the anterior face of the middle turbinal.

The mucosa is in the earlier stages bright red, but later it becomes pale and appears to be œdematous. Real œdema is often found on the lower edge of the hiatus, that is on the uncinate process and over the lower part of the anterior edge of the middle turbinal. Sometimes I have found the cells to contain glairy mucus or serum. This is often seen in the sphenoidal sinus. It is the opinion of most authors that both nostrils are usually affected, but not always to the same degree. It is generally conceded that it is in this type that polypi are found. I am inclined to accept the statement that bone disease is secondary to polypus formation, but many think

that it is primary. Purulent sinusitis frequently follows polypoid degeneration and that causes disintegration of the thin bony walls of the ethmoid cells. I accept the theory that the periosteum is secondarily affected and pressure, as elsewhere, produces changes in the bone. Sometimes the osteoblasts are more active and we find ridges and thickenings on the bone. At other times there is osteoporosis or atrophy, leading to excessive action on the part of the osteoclasts.

It is said that sclerosis takes place when inflammation subsides. I have recently had two cases of this kind, one in a medical student and the other in a nurse. Both had had previous operations. The ethmoid labyrinth was exceedingly hard and I found great difficulty in removing the walls of the cells. This had to be done because both were suffering from fetid manifest empyema of the posterior cells and the sphenoidal sinuses. It is then that "bare bone" may be felt, which Watson-Williams and others state is a diagnostic sign of degeneration of the ethmoid.

Polypi may be single or multiple. Where they are single, the polypus is usually found attached to the edge of the hiatus or the lip of the maxillary ostium.

Sluder says that this hyperplasia may have serious effects upon surrounding tissues. In the case of the sphenoid the ostium easily becomes occluded by the œdema and headache results, which Sluder calls vacuum-headache. This is not accepted by many European rhinologists. The hyperplasia outside and in front of the sphenoid region of the sphenopalatine ganglion must cause compression of that ganglion. If the ganglion be near the surface, that is two or three millimetres external to it, then there is much likelihood of the ganglion becoming compressed by the overgrown and hardened tissues and Meckel's syndrome is evident. But the ganglion may be as deep as nine millimetres and often escapes.

The headache of sphenoiditis is usually occipital, but may be vertical. As the ethmoid is also involved, there may be pain deep in the eye and behind the region of the lachrymal bone.

When the sphenoid is extensive and the optic nerve appears to be surrounded by the sphenoidal cavity there is probably asthenopia and some interference with the colour fields; if the fourth and third nerves are involved, there will be weakness in the corresponding eye muscles and pain after reading.

The headache has been thought to be due to dyspepsia.

One of my patients, a man over middle age, who suffered from persistently recurring occipital headache, was treated for some years with stomachic mixtures, tonics and massage. On opening up the sphenoid on the affected side the pains disappeared entirely.

Purulent Spheno-Ethmoiditis.

I am speaking only of the chronic variety and not of the chronic case with an acute exacerbation. It is these cases which are of greatest interest as the toxic and contiguous inflammatory effects have only recently been properly worked out.

In the latent type the discharge may not be in evidence at all or the patient may complain of "dropping in the throat." It is the other manifestations, apparently not connected with the nose, which are important. In the early stages the patient, perhaps once bright and happy, becomes apathetic, loses interest in the daily round of work, becomes thin and may become irritable, suicidal or homicidal.

An ex-nurse, about thirty years of age, married two years, no children, of bright and happy disposition, began to lose weight two years before; she became very apathetic, took little or no interest in her home and was supposed to be suffering from toxic absorption. I resected the septum and opened both sphenoids and found them more or less filled with muco-pus, mostly mucus. Six months later this patient had put on seventeen kilograms in weight and had become bright and happy, taking full charge of her home.

A maternity nurse, aged twenty-seven, complained of dulness, frontal pains and pains in the back of the eyes. On examination I found that the right ethmoid was obstructed by a bad deviation of the septum and that there was excess of moisture about the middle turbinal. I resected the septum and exenterated the right ethmoid cavity, opening a large cell, supero-external to the sphenoid. The left middle turbinal was partially resected. Both sphenoids were sounded but no discharge found. This patient is now much improved.

Mrs. M., aged fifty-two years, suffered from neurasthenia and fear of knives. The complexion was muddy and the patient showed low excitement. She talked constrainedly. I opened up some ethmoid cells and made very wide openings into the sphenoids; I found glairy mucoid material filling both cavities. Now the patient has quite a rosy colour, talks more quietly and has almost lost her fear of knives. Her condition is remarkably good.

In the manifest type there is visible pus or muco-pus in the nose, seen anteriorly in the cleft or posteriorly in the choana, on the middle turbinal or on the lateral wall of the pharynx. Sometimes it is seen in the vault. Often I have seen the grey muco-pus lying in the anterior commissure of the vocal cords or on the aryepiglottic folds.

This type can really be divided into two sub-types, the muco-purulent type in which the mucous secretion predominates, and the frankly purulent type in which the mucous membrane is denuded of its surface epithelium, and there is round-celled infiltration of the mucosa, that is true chronic inflammation of the cavity generally.

Mrs. W., aged forty-nine, was sent to me from a mental hospital, where she was being treated as suffering from homicidal insanity.

She suffered from nasal catarrh. Previously she had had her nose cauterized by one surgeon and some bone taken out of her nose by another.

I found that the lateral pharyngeal bands were red and enlarged, a positive sign of irritating discharge from the posterior sinuses. A partial submucous resection had been done and portions of the anterior ends of the inferior turbinals removed. There was a thin coating of muco-pus almost all over the mucosa of each nostril. I washed out the antra and found flaky, dirty discharge in small quantity, which I considered to be due to drainage from the ethmoids. My diagnosis was chronic empyema of the ethmoidal labyrinths.

Later, I operated. There was a large vertical gap in the septum, the result of a previous operation. I removed both middle turbinals and cleared out the ethmoid cells and opened up the fronto-nasal ducts; the left was very difficult to get into. I found the left sphenoidal opening, but could not find the right. The ethmoids were a degenerated and polypoid mass.

The present state of this patient is excellent. There are no mental signs whatever. But I insist on keeping her under nasal treatment and watching the sphenoids closely.

I have not seen any cases of the closed type in the spheno-ethmoidal area. It is due to obstruction which comes on slowly and the pus is suddenly cooped up as obstruction becomes complete. It is accompanied by severe pains deep in the eye or felt in the occipital region.

The symptoms are like those of the acute condition and therefore the treatment is the same.

Treatment.

The treatment of the catarrhal or hyperplastic spheno-ethmoiditis without polypi is a difficult matter.

I hold very strongly that the inferior turbinals should never be touched unless it be to remove a morulated posterior end or a small portion of the anterior end to permit easy flushing of an antrum which has been opened up.

In this type of disease I think it is sufficient to remove obstructions such as a deviated septum or a portion of the middle turbinal preventing the free access of air to the upper regions of the nostril. I give a long course of instillation of "Argyrol." Diet, fresh air, non-smoking and plenty of healthful exercise will help to cure these patients.

The treatment of polypoid degeneration of the ethmoid has altered completely in the last few years.

It is found that the bone of the ethmoid has become in long-standing cases completely disintegrated and that the whole mass loses its cellular structure. Fortunately the external wall seems to hold in most cases, though in a few the lamina does give way.

The only rational method of treatment is a radical one and that is a complete exenteration of the ethmoid labyrinth and, as the sphenoid is almost certainly affected also, it should be fully opened up. The tinkering method removing masses of polypi with a snare is unsuccessful and unkind. These are very apt to become malignant. Within this last year I have operated on three patients with malignant polypoid degeneration of the ethmoid which Dr. Pearson declared to be malignant papilloma.

The method of operating I shall discuss under the heading of operations. Sometimes one is able to complete the operation at one sitting, but occasionally one has to operate two or three times.

The operation is done under local anæsthesia only.

The Treatment of Purulent Spheno-Ethmoiditis.

Purulent spheno-ethmoiditis may or may not be associated with polypi. If associated with polypi I lean to the theory that it is secondary to the polypoid formation.

Where associated with polypi the treatment is that of polypoid degeneration of the ethmoid labyrinth *plus* infection of the sphenoid. This means some radical operation for the removal of the diseased bone along with all the polypi and the free opening up of the sphenoidal air sinuses. As the antrum and frontal sinus may be associated with this disease, it is necessary that they should be adequately treated; whether that is to be radical or not will be determined by the character of the case.

The Treatment of Spheno-ethmoidal Suppuration without Polypi.

The treatment of spheno-ethmoidal suppuration without polypi depends upon whether the suppuration is limited or universal (pan-sinusitis).

In latent empyema the infection is usually limited and not much in evidence. I should say that there are two types under this heading.

For the mild type with not much in the way of toxic absorption I should try climatic and local treatment before operation. It is difficult to decide where the discharge is coming from; often there is no discharge visible at the time of examination. As far as Christchurch patients are concerned, I like them to go to the hills where the atmosphere is free from dust and the east winds are less keen. I give "Argyrol" drops to be instilled at bedtime and do not order douching. Douching is of use only to get rid of discharge that remains clinging to the mucous membrane. In these cases discharge is not visible. It has to be looked for with great care. The patient usually complains of hawking a little in the morning or that the voice is somewhat husky, especially after talking or singing for a short while. Many of the patients get well with non-operative treatment. I treat children in this way always, even when the discharge is manifest. Under favourable conditions the children throw off what may appear to be a serious purulent rhinitis.

The severe type in which toxæmia is evident, aeration and efficient drainage are to be aimed at. Obstructions are first removed and this generally means correction of septal thickenings and deviations and removal of the middle turbinals. The conservative surgeons often stop at this unless they see pus issuing from the ostium of a cell, when that cell is opened up freely without damage to the lining wall beyond what cannot be helped in enlarging the ostium.

Others break down all the cells of the ethmoid on the affected side and open widely into the sphenoidal cavity.

The radical operators, such as Sluder and Ballenger, remove the ethmoidal lateral mass as a whole and take away as much as possible of the anterior wall and the floor of the sphenoid.

For manifest empyema the treatment is the same except that pus can be seen issuing from the ostia of the affected cells and this gives the moderate surgeon an opportunity of deciding which cells to open.

When the sphenoid and posterior ethmoid are affected, it is difficult to decide whether closed empyema exists. Symptoms must be more severe and approach those of an acute disease. The closure occurs because the ostium, already narrowed by the chronic œdema of hyperplasia of the mucous membrane, becomes occluded through exacerbation by an acute rhinitis.

Pain is deep seated around the back of the eye, in the region of the mastoid and between that and

the inion. There may be pain in the shoulder and down to the finger tips. Generalized headache and malaise are usually present.

The first part of the treatment is to cause shrinkage in the mucous membrane by the application of cocaine and adrenalin or antipyrine. Flushing with Dobell's lotion may bring about temporary cure. It is well to remember that there is always a reaction in the mucous membrane after the use of adrenalin and cocaine and the pain may come on again very severely four hours subsequently. This will depend on whether the pus in the cavities has been evacuated or not. If it returns, it is well to open up the affected cells at once. If not, it is better to wait until the acute stage passes off.

Treatment of Spheno-ethmoiditis in Children.

I see many children with spheno-ethmoiditis in Christchurch. My practice is to remove remains of tonsils and adenoids by the radical method and to leave the patients to recover by medical and climatic treatment. I consider that the lymphoid tissue of the mucous membrane, which consists of masses of cells in a loose stroma scattered about in the membrane in greater abundance in certain areas such as the turbinals and around or near the ostia, is the chief line of defence and offence against bacteria. This tissue in ill-health (toxæmia) gets "waterlogged," as one can see in hyperplastic tonsils and in the plaques on the pharyngeal walls. I have always held that there is a close association between this condition and inefficiency of the thyreoid gland. Therefore I put the patients on to small doses of the thyreoid extract and Lugol's solution once daily and order orange juice and vegetables. Meat I consider necessary and I advise against most of the starch foods.

But my chief instrument of treatment is mountain life in the open air, away from the dust of the plains and variability of the winds. It is astonishing how these patients throw off this apparently chronic suppurative sinusitis.

One must not forget that the ethmoid cells are very shallow and rarely become occluded in childhood. I have known an antrum washed out and ethmoid cells opened in a child under seven. Surely that seems to be unnecessary, as the antrum does not reach below the lower border of the middle turbinal before seven and I cannot understand how the washing-out was done. I do not like to think that it was done through the natural ostium.

Operative Treatment.

Ballenger's operation consists in the removal with special knives of the ethmoidal labyrinths *en bloc*.

Mosher's frontal ethmoid operation comprises the internal removal of the cells from before backwards by curettes, leaving the internal boundary of the mass containing the conchæ which may or may not be removed at the end.

Moure's operation is an external one. The cells are approached from the orbit, but without removal of the lachrymal bone or the *os planum*.

Sluder's operation is similar to Ballenger's.

Skillern's operation includes the removal of all polypi, of the anterior extremity of the middle turbinal bone, the opening of the bulla, the enlargement of the opening and the removal with Grünwald's forceps of the walls and the mucosa of the ethmoidal cells.

I shall describe my own operation. The preparation is important. For at least a week beforehand the patient instils drops of "Argyrol" solution at bedtime. If there be muco-purulent discharge, an alkaline nasal douche is used on rising in the morning.

If I suspect that the patient will bleed, I order large doses of calcium chloride for three days beforehand. For this operation and for removal of tonsils I have been in the habit of giving "Hemostatic Serum" on the eve of the operation. Unfortunately, exactly eight days after the operation four patients suffered from severe malaise with temperatures about 38·9°C. (102° F.) and a severe, fearfully irritating rash. This lasted about forty-eight hours. The day preceding the operation I wash out the antra to get rid of accumulated secretion which would damage the operation wound.

Local preparation consists in washing the vestibule with soapy water and cutting close to the vibrissæ.

Two hours before the operation a first hypodermic injection of 0·0075 gramme of morphine and 0·2 milligramme of atropine is given. This is twice repeated at intervals of half-an-hour. Half an hour before the operation the nostrils are gently packed with gauze saturated, but not dripping, with a solution containing 10% of cocaine and 0·0125% adrenalin chloride.

On the table the patient is in the supine position with the head and shoulders slightly raised. In addition to the usual sterile towels the face is covered with a gauze mask in the centre of which is a small diamond opening exposing the lower part only of the nose. This exposed part and the vestibules are painted with 1% solution of iodine. The first packing is now removed and the nostrils are packed with the same kind of gauze and cocaine, but more carefully and thoroughly.

The septal part of the vestibule is now anæsthetized by injecting under the perichondrium a solution of 2% "Neocaine" (or "Novocaine") with 0·05‰ adrenalin chloride.

An extensive submucous resection is now done, care being taken to remove as much of the vertical plate of the ethmoid as is found to be at all thick. A mere frame is left anteriorly and superiorly. The second gauze packing is removed if it has not been done during the resection and the nostrils are again packed with fresh material of the same sort. This packing must reach to the sphenoid and be placed carefully in the middle meatus. The septal wound is sutured. An interval of five minutes should be allowed. The middle turbinal is cut through with scissors and removed with forceps. I pack the nose with gauze soaked in the anæsthetic: often one is able to anæsthetize Meckel's ganglion and the whole ethmoid area becomes insensitive.

I now use Faulkner's method and proceed to break open the ethmoid cells from above and in front downwards and backwards. The uncinate process with any cell or cells it may contain in its upper end, is removed by firm pressure with the rectangular spoon curette. This does not scrape. The pressure must be sufficient to cut through the bone and lift away the inner walls and portions of the horizontal walls of the cells. The partially detached portions are removed with Bruning's or Grünwald's forceps. The fronto-nasal duct is sounded to determine its patency and whether there is infection of the sinus. I use Watson-Williams's instruments which are use ful for breaking open the infundibular cells obstructing the duct. Removal of the ethmoid labyrinth is carried on steadily to the sphenoid.

If there be pain, repacking is carried out and an interval of five or ten minutes allowed. If the pain be severe, the application of a drop of equal parts of cocaine and pure carbolic acid to the mucous membrane overlying Meckel's ganglion will greatly reduce the sensibility. If this does not have the desired effect, it is because the inflamed and infiltrated tissues will not absorb the anæsthetic. Then it is better to postpone further procedure for a month, when the operation can readily be completed.

The ethmoid cells are wider posteriorly than anteriorly. Therefore one must curette more externally as one proceeds backwards. Great care must be exercised because the posterior cells when enlarged, may be in close association with the optic nerve. The mucous membrane, if possible, should be left undamaged to facilitate speedy regeneration of the mucous membrane of the resulting cavity.

The next procedure is to locate the sphenoidal ostium. I introduce a small spoon curette and break open the ostium until it will admit the sphenoidal punch forceps. I punch away the anterior wall towards the floor of the sinus and internally. One should be careful about punching too far externally and inferiorly, firstly, because there is a largish artery in the floor of the sphenoid which is difficult to control, and, secondly, because the sphenoid may surround the optic nerve where the cavity is large. I do not curette the cavity. In bad cases of suppuration with pain I endeavour to remove a portion of the floor.

Peroxide and antipyrine are used to stop oozing during the operation. But, if one take plenty of time, the bleeding and pain are not troublesome. The operation, including the pauses, takes about one hour.

There is no sign in 99% of patients of operative or anæsthetic shock. No packing is left in the nose.

Morphine and "Aspirin" are used freely to combat the headache and reaction which come on in two or three hours.

Douching is commenced in forty-eight hours, and is facilitated by the use of an antipyrine spray.

The patient generally leaves the hospital on the eighth day.

The after-treatment is very important. Close attention by the surgeon must be given to the changes in the nose in healing. Watch must be kept for discharge from any unopened cell. It is impossible to get at some of the cells. Those that extend into the roof of the orbit, may be absolutely inaccessible.

The sphenoidal ostium must be kept open, for as long as the inflammatory reaction is active, œdema will tend to obstruct the new opening. Weak solutions of silver nitrate and "Argyrol" are beneficial as applications. It is astonishing to see the improvement in these patients. Loss of sense of smell may occur, but smell is regained in from two to twelve weeks.

Where the sphenoidal opening is found to close down again, it is said to be due to hyperplasia of the mucous membrane, but I believe it is also due to new bone formation, because I have had to punch away more bone on several occasions.

This work is difficult, but when one finds that chronic headaches, neuralgias, mental irritability and depression, dyspepsia and general ill-health are relieved and often cured, it is worth while. I never carry out this operation until I am assured that there is no other discoverable cause for the patient's symptoms.

Dr. G. Piness (Los Angeles) thought that many of these cases of spheno-ethmoiditis in children were due to allergy. He considered that the water-logged lymphoid tissue of the mucous membrane was not infected tissue, because there was no small round-celled infiltration, but mononuclear cells were found in preponderance. It was due to lymph œdema and these children were potential asthmatics. He advised against hæmostatic agents before bleeding occurred, but thought it helpful to test the coagulation time so as to be prepared for hæmorrhage.

Dr. W. J. Macdonald (Wellington) considered that the preliminary use of "Hemoplastin" was unsatisfactory and cited two cases in which "Hemoplastin" had been given to patients who bled for six hours after operation.

Dr. J. Hardie Neil (Auckland) said that sometimes very dense ethmoids were encountered. Vacuum headache in frontal sinusitis was a symptom; pressure was a myth and one got negative results if only the obstruction were removed. He did not find skiagrams of much help. Some cases were postantral after coryza. Spheno-ethmoiditis in children was a bone of contention between pædiatrists and oto-rhinologists. Mass operations were rightly condemned because of hæmorrhage; there was a fairly heavy mortality. He referred to points of technique in packing and said that removal of the inferior turbinal bones showed lack of surgical experience.

Dr. R. Pulleine (Adelaide) said that inflammation of the posterior ethmoidal cell in the middle turbinal bones caused a latent sinusitis which was sometimes very puzzling. There was not much secretion and yet the condition caused violent headache. In treating it he split the turbinal bone and squeezed out the secretion. He considered that vacuum headache due to obstruction of the fronto-nasal duct was common. It was most important that all mental patients should be examined for sinus disease. In his opinion the hyperplastic form of spheno-ethmoiditis was rare. He thought that sinusitis must be common amongst Maori children, for he had seen in the North Island several children from whose noses pus streamed. He agreed that deformities in the septum or in a sinus might cause an acute sinusitis to become chronic. He emphasized the intimate and varied relations of the optic nerve to the sphenoid cavity so well shown by Onodi. He had seen several cases of retrobulbar optic neuritis due to sphenoid trouble and the causation of these cases was often missed by ophthalmologists. In regard to the tendency of the sphenoidal cavity to contract. he found that by breaking down the wall between the

posterior ethmoidal cell and the sphenoid there was less difficulty in keeping it open.

DR. H. J. GRAY (Perth) used cocaine paste for anæsthesia in preference to packing and thus obviated sweating and collapse. He used dental broaches for carrying the cotton wool. He found X rays helpful at times, particularly to show pansinusitis or to isolate a maxillary sinusitis. He considered that bronchiectatic symptoms were due to the whole of the respiratory tract being affected in the same way. The closing of the opening made into the sphenoid was a great bugbear; if the opening were too low, it was more liable to close. He thought that if he could clear out the mucosa, he would get better results.

DR. A. J. HALL (Dunedin) asked whether optic neuritis and atrophy were often produced by toxic causes.

DR. W. J. DENEHY (Melbourne) preferred cocaine and adrenalin paste to packing. Large quantities of solution were necessary in antral lavage. He preferred local anæsthesia, but in some operations he used preliminary packing with cocaine and adrenalin and then intratracheal general anæsthesia.

DR. T. A. MACGIBBON in reply said that 50% of children in Christchurch were sufferers from spheno-ethmoiditis and if all these were potential asthmatics, there would be a tremendous number shortly. He considered that X ray work was a matter of personality, but often very helpful if good plates could be obtained. He thought a common fault in bronchiectasis was paranasal disease and considered that vacuum headache was due to sinusitis. The block operation for ethmoiditis was a dangerous one. Pansinusitis in Maori children was probably due to syphilis. He believed in removing the middle turbinal bone for disease of the posterior ethmoidal cells contained in it.

SECTION VIII.—NEUROLOGY AND PSYCHIATRY.

SOME REMARKS ON THE EDUCATION OF MENTAL DEFECTIVES AND AFTER CARE PROVISION FOR THEM AS WELL AS THE DISCHARGED MENTAL PATIENT.

By OLIVER LATHAM, M.B. (Sydney).
Pathologist, Mental Hospitals Laboratory, Government of New South Wales.

Early Personal Experiences.

Those of us who have lived in or traversed the dead ends or byways of old time countries where a strong religious life still exists, must have noted with wonder not only the happy, industrious, well taught and guarded lives of those simple folk whom a later acquired professional outlook enables us to classify as mental defectives, but also lower grades whom we would now call imbecile and in not a few cases even in the families of the very poor but honest, actual idiots whom we considered overgrown babies well behaved in public. We remember that these simples came to our homes on messages for years without meeting damage, took part in all the most arduous work on farm or kitchen life and were kindly and respectfully spoken to and treated by the neighbouring population. We can also call to mind those whom we thought a little dense, but whom no one thought for a moment of associating the word "mental," who received wages and carried on in their quiet way. Unfortunately the writer was not sufficiently high graded himself to deduce from these simple facts that the period of alarm (Davies) which enveloped a thinking world, especially the American thinking world, after the publication of some Binet test statistics, contained many absurdly exaggerated concepts and fears, to give way to a saner and more ordered view when similar but larger groups of mortals like to the above came to be examined in a scientific way—a science, by the way, having its birthplace in France and much of its childhood in the United States.

Having taken up the mental aspect of medicine as my life's work and having been associted with Miss Paterson's "After Care Association for Patients Discharged from Mental Hospitals" almost from its inception, I found much that was of service to me in the numerous articles appearing in many American journals, especially the *American Journal of Insanity*, the *Alienist and Neurologist*, the *Psycho-analytical Review* and the *Journal of Abnormal Psychology*, and thus became familiar with many names and ideas now so well known the world over since these authors have become built into the modern structure of applied psychology as it were, whose scaffolding we saw being erected in the face of so much opposition and discouragement, until the work of each research school could be correlated and the results evaluated and until the experiments should have had time to mature and then stand the test of visitors and students from all countries interested in the same problems and anxious to do field and laboratory work where so many social psychological experiments could be examined.

One of the earliest lessons that seemed to be brought home to me was that among truant school children where the intelligence quotient was not necessarily often below normal, the inability to concentrate for any length of time on the average school lesson was a very marked feature. In the sequel this was shown to be still more a trait of mental defectives, if the attempt was made to keep them up to their comrades of the same actual age. brought home to us was that among truant school By having smaller classes and arranging the teaching so that (i) the so-called school book lessons did not exceed twenty minutes each and (ii) the total time spent on these abstract lessons did not exceed one to two hours without being interlarded with such change of mental exercise as would be provided by practical work, vocational training, games and plenty of fresh air and so forth, it was found that in the great majority the truant habit disappeared and that even many so-called retarded cases proved to be those who in big classes never understood the idea of how to work and who after a longer or shorter stay at the special school caught up to their old companions when returned to the normal school. We except, of course, children obviously mental or of too low a mental standard. Again in our mental hospitals are to be found imbeciles of every grade and here too under supervision and the encouragement of advice, praise and little rewards chiefly in the way of special privileges quite good work is being done in nearly every division of labour.

Some Efforts in New South Wales.

Besides this mental after-care effort of Miss Paterson and her friends, I have to mention the State

Children's Relief Department because they provide for deserted women and children and such like, among whom are to be found various degrees of mental deficiency and actual psychotic states and, of course, physical disabilities and thus we have in being an established institution with its social workers and all that and they have actually established a special home and school for some of their social misfits. I call them thus because the whole institution is not sufficiently large to allow of proper classification.

I must, of course, include the Department of Public Instruction because it has not only established a school medical service, special schools or classes, Montessori classes, for instance, but recently also a large special industrial school for mentally defective boys and girls at Macquarie Fields, near Liverpool, to be opened in the near future and on whose committee of advice I have the privilege of serving. We have under the Education Department also industrial schools (both sexes) for the Court cases where some school education as well as vocational training is provided. A recent psychological survey of one hundred girl inmates taken at random by two research students under the direction of Mr. A. Martin revealed the following figures:

Terman's Type of Mentality	Corresponding Range of Intelligence Quotient.	Percentage of such Individuals in the Institute.
Superior Intelligence ..	110-119	1
Average	90-109	10
Dull	80-89	10
Border Line	70-79	34
Moron	50-69	33
Imbecile	below 50	12

The average intelligence quotient was found to be 70, that of border line deficiency. At least 80% of the inmates were on the border line or below it.

Our late Inspector of Mental Hospitals deserves credit for establishing a special Montessori class for the higher grades of imbeciles and mental defectives among the children of the Newcastle Mental Hospital. The teachers had to devise a combination of diversional and occupational therapy, being much happier in this latter effort than in any modification of a State school curriculum, but still better, I think, would be direct action, that is, real effort in gardening, sewing and so forth, real vocational training, our mental hospitals always having room for carpenters, painters, plumbers, gardeners and other tradesmen.

In this respect great credit is due to the initiative of the late Colonel Miles, C.B.E., who when made medical superintendent there as long as twenty-five years ago at once instituted a tailoring class. So adept did he find the young imbeciles that he soon had the stores filled with clothes and every patient with his Sunday suit. Still imbued with the vocational idea I tried to induce Dr. Sinclair to allow Mr. Fleming, an energetic officer in charge of a branch mental hospital in Stockton, near Newcastle, which included among its inmates about 150 imbeciles of various grades to start poultry yards, flower and vegetable gardens and even to hand the piggery over to the better of these girls under women outdoor workers. His answer, I think, showed some of our difficulties and the need of a psychological research bureau with its trainees and access to a complete system of industrial school systems, farm colonies, factory hostels, social service corps and so on. Dr. Sinclair reminded me that: "Women, being of delicate and refined nature, were meant for the gentler arts of the needle room and would be coarsened by contact with such manual work as I outlined." Now from a medical point of view I have always maintained that women need the same modicum of fresh air and outdoor life and motion as men, if they desire the same modicum of health. All reports seem to indicate that women's handicap and men's salvation in the tropics or at least tropical Australia seem to depend on that aspect of their lives and many a woman, worried, disappointed and stale from unnatural office and too much house work, has found salvation in her garden and among her livestock. Surely experience has shown us that open air work and exercise purifies our clothes and bodies, making us feel healthier and as one recedes down the mental scale these items become increasingly important. Animals are better in the open.

Another experiment might be noted here. Dr Underdown Prior who is so interested in endocrineopathies, found that he had a suitable attendant and obtained leave to allow this man to take as many patients as he could into a fruit garden. At times he actually managed about 60, many so hopeless that they would not be worth the attention of the ordinary gardener. The whole area became a vegetable garden and gradually all the patients became interested and most did some sort of work. Experiences like this point the way with no uncertain hand to the value of direct action in our efforts to get the individual as soon and as directly as possible right on to the work which best will maintain him in the world he will live in.

Practical Experiences in the United States.

Many of my associates have visited America and seen in practice some of their activities in this line and some excellent reviews have been published. It would seem that for years they have had for cases chiefly recognized by means of the Court, industrial schools. After a time both public and private special schools, colonies or whatever one cares to call these institutions where mental defectives could be specially provided for, specially trained, permanently kept if necessary and in most cases paroled sooner or later to friends or allowed to get work. In any case they seem to have developed to a great degree the visitor or social service agent. This visitor not only keeps in touch with the patient when he finds work and acts as his trusty counsellor and really is a tower of strength to him, but also helps the various examiners in finding out important details of his previous life and family history and environment. Some of these institutions have developed the idea of having small farms

bought or rented where the boys and girls as soon as they have reached a certain stage in their education, manners, self control, self confidence and so on and seem to be beginning to get "fed up" with the restricted atmosphere of the parent institution, may go in batches of say twenty under the real farm life conditions of living under the care of a proved and trained married couple.

This is considered a stage in their education to fit them for the outside world, for while here they are encouraged to find work with neighbouring farms and factories and indeed similar hostels for girls have been devised where they could be near a factory. Of course, it was always a *sine qua non* that the employers represented wholesome conditions of life and work and it appears this sort of worker is most welcome to the farmer and manufacturer. Many of the mental defectives would be paroled after some training to their own homes, if suitable. After some time the Binet-Simon and other performance tests were applied to all applicants and the results carefully preserved and tabulated. From the mass of facts thus gathered seems to emerge the conclusions following:

(i) If all available children of school age be examined by these systems, a certain number will be classified as mental defects, that is, will have an intelligent quotient of less than 70% or if over sixteen years of age, would have a mental age of less than twelve years. Suppose for instance that we found 1% to 2% testing such in a certain district, and that would mean between 20,000 and 40,000 children were mental defectives, an extraordinary and ludicrous position might well arise and indeed did arise when it was pointed out that if we obeyed our social conscience, all these young people should be segregated to prevent their propagation and their chance of getting into mischief and trouble.

(ii) The fallacy in this line of argument arrived from our not noticing the actual facts of the case. For instance the first interesting point evolved was that mental deficiency is not a clear cut entity, but an arbitary classification, that the whole human population, if charted with regard to their mental powers would represent a curve, that is that no sharp line separated one from another. The mental defective did not have specific particles in his germ plasm which might come out in his descendants like a yellow streak, but possessed lesser grades of powers and when mated with a normal might conceivably have a normal child and this is what has been proved time and again in spite of the most vehement vaunts to the contrary. Even two mental defectives when mated did not always have mental defectives as offspring as they should have done if mental deficiency was a specific character. This means in a word that they were a part of the community which could be classfied like any other group in a community into (i) relatively normal as to type, (ii) those with mental peculiarities (we may perhaps call these psychotic) and those (iii) with bad moral tendencies.

One could go on and include epilepsy and a host of physical conditions.

Other points brought out might perhaps be put down as characteristics resulting from their mental calibre rather than specific qualities of their germ plasm and one of these is that they are as a class extraordinarily easily led. Their appearance, conduct and life in truth reflects their home life. Well brought up, suitably taught in regard to their capacity to learn and many of them remained *perdu* in the community, unobtrusively earning their living in posts demanding constant toil, repetition and relatively little responsibility. That this is a commonplace is evidenced by such happenings as a research worker telling a manufacturer after a field day mentally testing his workers that so-and-so among his employees were mental defectives, and the employer turning round on the examiner and saying: "But these are my most reliable and constant workers!"

Other evidence goes to show that the males paroled on recommendation very seldom committed sexual offences and indeed in lower grades often remained unmarried. Probably they lacked spirit to be gallant.

The female element naturally were sought out and did not need any initiative to get into that trouble. Curiously enough the histories of paroled female mental defectives showed remarkably few children; here again it seems as if it were the psychotic and immoral element among this group who supply those glaring lists of mental defectives appearing at police courts and lying-in homes and it is here where the great value of this American experience comes in, because the most stupid and the immoral and psychotic types get caught or attract notice.

Exercising pure logic, we might profitably inquire into the life histories of a State population, leaving out all those testing below an intelligence quotient of 70% or other standard. We might take such a quality as honesty and sexual morality and I think our findings would be that this group more easily acquired a knowledge of social demands and thus felt compelled to practise greater discretion and wariness, so that in the one case we kept within the letter of the law, often a proverbially threadbare cloak for dishonesty and in the other case we avoided scandal by a variety of means denoting a high degree of intelligence. A real advance would be an estimation of what percentage of all mental defectives discovered at school age could of their own family effort make good in the community and what percentage would make good if taken from families themselves too stupid to direct their offspring properly or were of the vagrant or criminal class and who could be directed in character and vocational training in the special school system for mental defectives.

Also what percentage although harmless and moral, yet could not apply themselves successfully in the community, what percentage were definitely psychotic, in minor ways preventing their social absorption in the community, in major ways needing possibly the services of the department of psychiatry and lastly the percentage of those with

the same immoral or criminal tendencies as beset their more intellectual *confrères*, numbers of whom find their way as we all recognize into mental hospitals and prisons.

These percentages known and we could set about deciding a generous comprehensive scheme to deal with all the mental defectives needing direction and we should then not hold exaggerated views such as "so many defectives in a community, so many beds must be provided for perpetual seclusion."

Programme for the Treatment of the Mental Defective Problem.

I should like to see established preferably in the State University a faculty of social service. Up to the present time this subject has mostly been dealt with under the wide activities and sympathies of the Faculty of Psychology or mental philosophy. This would provide a means of giving special instruction to medical men, all classes of school teachers and those individuals who leaned towards service or were already employed in that capacity. Associated with this faculty or to the Faculty of Psychology till the former faculty were formed would be a psychological clinic where specially trained medical men, psychiatrists and neurologists, non-medical psychologists and their assistants and social service workers would hold their inquiries. To them would be brought for diagnosis and suggested forms of treatment children not making good in school or family or from the children's court. This clinic would have authority to parole children back to their parents after instructing the latter and the children would be visited in their homes by the social workers or brought back for re-examination at stated intervals. They might also have authority to recommend their admission to special truant schools under the authority of the State Department of Education or, if a more vocational education be diagnosed as necessary, then to such schools for mental defectives as are being placed in commission at Macquarie Fields. Farm colonies doubtless will be tried and on similar lines, hostels near small factories rural, suburban and urban. Lastly provision of an institutional nature for those who will need permanent care for the rest of their lives, although a few of these might easily find a place in some of the farm colonies, doing house and garden work under the supervision of the principals there. Quite a number of these farms and hostels seems more than able to pay their way if we can take as correct the many statistics presented to us and meanwhile a number of people are being put into the way of doing work of a kind often declined by the more ambitious or fastidious members of the community and at the same time have been infused with a sense of their own worth, in a word self confidence and self respect.

The Responsible Parties for These Institutions.

The clinic or bureau for child study might be placed under the authority of the University and the Government would give a grant.

The State Education Department would have charge of the special Montessori schools, special truant schools for backward or difficult children whose intelligent quotient lay over 70%, that is who are not mental defectives, and as apparently they have made a start with Macquarie Fields, they might also have the responsibility of the many other similar schools we hope to see erected.

There is also that branch of the public service called the State Children's Relief Department, which has the spending of public money for the provision of State children, boarding them out, providing for widows and their families when they must temporarily come on the State and which, as I have related, started a special school and home for those State children who are mentally defective.

This service might be enlarged to take up these duties, especially the farm colonies, if it should prove impractical for the Education Department to do so. The Education Department already manages the industrial schools for Court cases.

Doubtless many parents and guardians will fetch their children up to the various psychiatric clinics which will be described in connexion with the after care of mental patients and thence they would be referred to the nearest branch of the parent child study bureau of the University. There is no reason why these mental defectives with a psychotic element should not avail themselves of this psychiatric clinic on discharge, should they feel the need of medical advice in a mental way.

The After Care of Mental Defectives.

I have already indicated that many mental defectives are looking after themselves and need no attention. I have also outlined the importance of the visits and advice of the social service worker who acts as a check and also as friend and keeps headquarters informed of general progress. I have alluded to the utmost importance of providing wholesome surroundings in every sense of the word for all mental defectives out on parole especially in their teens, since lessons once learnt, tend to stick and to be difficult to unlearn.

The After Care of Mental Patients.

For many years now the Mental After Care Association has visited mental patients recommended for discharge, acquired their confidence and attempted to find suitable situations agreeable to their recognized peculiarities or supplied a little money to buy tools of trade, a few articles of dress and the like, part of which monetary advance was often returned with grateful letters of acknowledgement. The secretary and members of the committee have been in touch with similar institutions in England and America. In the latter country mental after care has reached extraordinary dimensions, out patient departments being established in connexion with many mental hospitals for treatment of home patients or those discharged and social service workers learn of any home conditions likely to cause a relapse and advise accordingly. The After Care Association in New South Wales has recently established a small hostel with seven beds in a country suburb where female mental patients may have a month or two of rest before facing the world again. This has been greatly appreciated, but, of

course, only touches the fringe of things. We must not forget to give due praise to the New South Wales Government for initiating a plan whereby certain patients in metropolitan hospitals are given a few weeks change in open door wards in the high altitude country mental hospitals of Kenmore (2,000 feet) and Orange (3,000 feet) before discharge. Further, in the new mental hospital, Broughton Hall, reserved almost entirely for uncertified cases, a psychiatric clinic is held regularly where out patients or anyone feeling ill after departure from a mental hospital, may seek advice should they be unwilling to face their own hospital again.

A Psychiatric Clinic as Part of a General Hospital.

Our late Inspector-General, Dr. Sinclair, tried hard to get these clinics established in the general hospitals and it has been the happy fortune of our present chief to see established in the Royal Prince Alfred and other Sydney hospitals, in Parramatta, Orange, Newcastle, Goulburn and other country towns such clinics attached to their general hospitals. At the Royal Prince Alfred Hospital we have several mental physicians, who are in touch with all the other honoraries for any physical treatment that may be desired and certain cases have been referred to Dr. Martin, Lecturer in Psychology in the University of Sydney, for such further study and diagnosis in work he specializes in. Naturally our hopes are that as many as possible of these clinics will be completely fitted out with regular neurologists, psychiatrists, non-medical psychologists and all such means of neurological methods of diagnosis and treatment as have been outlined in Dr. Hogg's paper on the teaching of psychiatry and the diploma course in the University already before this Congress.

Mental patients discharged from hospitals would have little dislike to visiting such clinics, as a thing quite apart from mental hospitals and where other specialists were available and might even meet some of the social service workers there and learn to recognize their value and to encourage their ministrations, the wide field for whose usefulness has been clearly outlined by Dr. Stuart Moore in an address on penal reform in New Zealand.

In conclusion, the objects of this paper will largely have been achieved if I can rouse up Australasian feeling, public and medical, to a deeper sense of the fact that we have as yet progressed but a small way compared with our American friends in the whole field of occupational therapy.

We must aim at least in reaching the standard where a State director of occupational therapy directs his or her innumerable qualified and highly trained workers in every sort of institution and home where they commence if need be in habit training, leading on to *Kindergarten* work. Then work in the wards, manual labour, thence advancing to the occupational therapy centre and so to the prevocational and industrial workshop by which time the patient has a chance of feeling in complete harmony with his social equals in the world of industry, that is he regains or obtains adaptability to his surroundings. At the same time, on similar lines the sick and crippled who are bed-ridden, are attended to and are thus in their treatment brought into line with the blind who in our parent State have been so well provided for and whose work and achievements have received world wide recognition.

THE SOCIAL ASPECT OF MENTAL DISORDER.

By S. A. MOORE, M.D. (Edinburgh), M.R.C.P. (London),
Dunedin.

WHAT is the mental defective? The law answers with a social definition in which it is the degree not the nature of the disorder that counts: A person who, owing to his mental condition, requires oversight, care or control for his own good or in the public interest, and who falls into one of the six classes: persons of unsound mind, idiots, imbeciles, feeble-minded, epileptics; a seventh class, moral imbeciles, has been suggested.

This definition corresponds fairly well to popular usage.

Modern psychologists who would "measure the mind" define him in quite a different sense as one whose intelligence quotient is below 70%. Owing to inborn causes he has a defect of general intelligence. He may be an industrious, sober and specially valued workman who rears a virtuous family. On the other hand the supernormal of the psychologists may be a thief and extreme pervert, neurotic or insane. One supernormal, I belive, is an inmate of a special residential school for mental defectives in New Zealand.

The widespread confusion that arose from the use of the general term "mental" in a very restricted sense is only now subsiding. It is still common enough among the liberal professions and statesmen and is to be detected even in the report of the special Committee of Inquiry on Mental Defectives and Sexual Offenders made to the Honorable Minister of Public Health in New Zealand in 1925.

If we disregard the degree of mental deficiency and attend only to its nature, we have three things to consider: (i) pure general intelligence, (ii) integration of personality, (iii) development of ideals.

Defects in these cause respectively an intelligence quotient below 70%, a neurosis or psychosis, immorality or delinquency.

Any conceivable combination of normal and supernormal or defective states in conditions of these three natures may be combined in any given person. Disproportionate, relatively precocious development of one of them, for example, intelligence, may create a disturbance in others.

It is not necessary here to classify further according to the degree of these conditions or along other lines.

In any community there are unbroken series of mental efficiency in individuals from the genius to the idiot (intelligence), from the unified personality to the raving maniac (integration), from the saint

to the devil (ideal formation). No sharp line of demarcation exists in these series. Hence it follows that the problem of mental deficiency cannot be separated from, but can be efficiently tackled only as part of the problem of mental health of the whole community. Further, it is obvious that sterilization cannot prove a radical remedy.

The complete summary of findings given by the New Zealand committee on which they base their chief recommendations, is:

> 1. That the unchecked multiplication of the feeble-minded and epileptic is leading to a continually growing addition to the sum of human misery, an ever increasing burden on the State and the serious deterioration of the race;
> 2. That it would be sound economy as well as in the best interest of humanity to deal with the problem at once even though it would involve increased expenditure.

No one here will quarrel with this second finding, but it is difficult to understand how the first one can be made to square with other statements of the committee, namely:

> Probably New Zealand has much the same proportion of mental defectives as other countries. This is stated to be 2% or 3% (Section 5).
>
> 2. Fortunately the number of epileptic children in New Zealand is apparently small (Part II, Section 7.).

Some extracts from the text of the report may be of interest:

> Unless the multiplication of the feeble-minded is to go on in an ever increasing rate with consequences dreadful to contemplate (Section 9).
>
> This is the question: "Can the propagation of mental defect by mental defectives and the debasing of the race thereby be greatly checked if not completely prevented?" The answer is: "Assuredly yes, by segregation and by sterilization" (Part II, Section 10).
>
> This problem should be boldly taken in hand at once, while the evil is within manageable proportions, instead of allowing it to grow into an intolerable burden (Part II, Section 12).
>
> It is certainly practicable and as likely to be favoured as opposed by public opinion.
>
> The feeble-minded are extraordinarily prolific (Part II, Section 1).

It is perhaps unfortunate that the committee sat at a time when a wave of panic was at its height influencing not only the public but also professional opinion.

The chief recommendations of the committee centre round the creation of a eugenic board.

This board is to decide whose names from among the following classes shall be placed on a register: (i) The feeble-minded who are not inmates of asylums, (ii) epileptics who are dangerous, immoral or antisocial, or juvenile epileptics with frequent fits that they cannot suitably attend ordinary schools, (iii) moral imbeciles, (iv) persons discharged from mental hospitals.

The right of appeal to a judge of the Supreme Court is to exist.

Marriage with any registered person is to be illegal and coitus with such an indictable offence.

The board is to have power to order the removal of feeble-minded and moral imbeciles to farm or industrial colonies to be established for custodial feeble-minded and delinquent persons.

The board is to consider the operation of sterilization (vasectomy and possibly salpingectomy) in cases of recurrent insanity, idiopathic epilepsy, high grade morons and certain others to have power to make sterilization a condition of release, but only on probation and supervision for a reasonable period.

Would the committee today care to hint that there is any hope that by the adoption of these proposals the propagation of mental defect by mental defectives would be greatly checked if not entirely prevented?

Yet the view that the only radical attack of the problem is segregation and sterilization probably has still enough life in it in New Zealand to make some further remarks worth while.

The man in the street observing how mental and moral obliquity runs in families, familiar with the breeding of dogs and under the belief that our knowledge of heredity is much greater that it is, often thinks that any attack on mental deficiency through environment is hopeless: while the modern belief in the importance of environment implies that we in New Zealand are so happily circumstanced that we shall succeed if we make a determined effort on enlightened lines in doing for mental deficiency and juvenile delinquency what has been done for infantile mortality. Many a man in the street, however, still thinks that such a hope is Utopian.

But, not only is it recognized that the attack on mental defficiency can be efficient only if it is part of a movement that aims at raising the general level of mental health and civilization of the whole community, but it also follows from this that State departments alone cannot deal with this problem. The active sympathy and enlightened cooperation of the whole community is needed.

In man development of the mind is post-natal to an extent and degree that does not at all obtain in the case of the body itself. Hence it is that the environment, not only the physical, but particularly the mental, emotional and moral environment, exerts comparatively to what occurs in the body, an extraordinarily profound influence in the creation of mental structures and in the development of the mind. Civilizations are not hereditary, but are transmitted through the mental environment into which a child is born.

History also shows quite a definite relation of the environment influence of climate to the rise of civilizations and even with the type of philosophies that have arisen in various countries. It is chiefly by the retention of this primitive but plastic type of mind at birth that man keeps his capacity of aquiring various types of civilization and of losing them.

We read of "the great strides made during the last half century towards establishing laws and theories of genetics and heredity." What, I would ask, are the great strides that have been made in our understanding of the origin and heredity of mental

deficiency? The greatest discovery concerning heredity in modern times is Mendel's law. If mental deficiency obeys this law, then it has been computed that in order to reduce by segregation and sterilization the proportion of mental defectives in a community from one in a hundred to one in a thousand would take twenty-two generations, to reduce it further to one in ten thousand would take sixty-eight more generations and to reduce it to one in a hundred thousand would require two hundred and sixteen more generations. But mental deficiency, it is now agreed, does not obey Mendel's law in its transmission.

In reality we know very little about heredity for variation and heredity are but two aspects of the one problem and there is no general agreement about the causes of variation. Biologists have taught us the doctrine of the immutability of the germ plasm, but we do not altogether believe them. The succession of types of animals that has appeared on our planet suggests that the cooling of the earth and the relative amount of carbon dioxide and oxygen present in the atmosphere at successive ages are related in some way as cause and effect. Mutation, the most orthodox theory of a cause of variations, rests on no proved example. Lotsky, however, has proved that hybridization does cause variation that is the arising of new forms, and this at present is the only proved cause of it. He says that no two individuals that result from sexual union, are exactly alike. He therefore denies the existence of species and regards every sexual mating as a hybridization and sexual production as the cause of variation.

No serious attempt has yet been made to lighten the darkness of our ignorance of the origin of mental deficiency by Lotsky's work.

When Mendel's law was operative, the germ plasms act as if a physical mixture occurred and the resultant offspring give evidence of the play of the mathematical laws of chance. No new type of characteristic arises but mere blendings. When a true variation arises, the germ plasms have behaved in a manner analogous to what occurs in chemical action as when oxygen and hydrogen combine to form water, the properties of which could not be foretold from a knowledge of the oxygen and hydrogen. The blue colour of a copper sulphate crystal disappears if you remove the water or any one of the constituent elements, copper, sulphur, oxygen or hydrogen and oxygen. The blue colour, therefore, cannot be regarded as due to any one of them, but is due to the combination of them and may be compared to a variation which is a new and unforseeable thing.

Tredgold's theory of germ impairment as a cause of mental deficiency is environmental and has many supporters. Deficiency in food tonics (vitamins and minerals) toxins of syphilis, tuberculosis, alcohol, metals and so forth are suspected agents and there is some real evidence to support this view. Apart from the chemical action of these things in causing primary amentia or other conditions, we know that the behaviour of the victims of alcoholism produces severe emotional traumata in children and others, which are a fruitful source of mental disorder. The efficient treatment of every case of neurosis, of insanity and of alcoholism is an important measure for the prevention of mental disorder. At present practically no methods of dealing with the alcoholic exist in New Zealand. It is often impossible to do anything with that class of alcoholic whose vice both reveals and is caused by a latent psychosis: yet he is a centre from which there freely radiates mental ill health.

If entrance to an asylum comes to imply the possibility of prohibition of marriage even after sterilization, the extreme difficulty which the practitioner often has in gaining consent to certification, will be increased enormously and early treatment will cease to exist altogether in asylums.

Methods of Dealing with Mental Deficiency in New Zealand.

The information here given is gleaned chiefly from Part II, Section 7 of the committee's report. It is the legal mental defective with which in this part of their report they are chiefly concerned. I am also indebted to the Education Department which is displaying great interest and enthusiasm in this subject, for a letter sent me and have drawn slightly on other available sources of information.

We have mental asylums in which, I understand, the clinical medical staff is to a considerable degree burdened with administrative duties.

The asylum service is a purely State service. The fact that the treatment of crude mental illness is the affair of the State, while bodily illness is the affair of the hospital boards, tends strongly to perpetuate the segregation of mental from general medicine. Our State service does not appeal for nor receive the active sympathetic cooperation of the whole community in the form of bequests, benefactions and the like or voluntary social work. It therefore walks with wooden legs.

There is usually a tendency in State institutions for criticism from within to be stifled.

Sir Truby King has recently introduced increased facilities for classification of patients, a greatly needed boon. It is now also possible to have patients with *delirium tremens* and other mental conditions admitted to a ward in the general hospital. The building and its amenities are unsuitable. A psychiatric outpatient department has been started in the general hospital, but is as yet quite inadequately housed or staffed.

There are special residential schools at Otekaieke for 195 boys and at Richmond for 80 girls.

These schools have separate departments for children of school age and for older children who are taught farming and handicrafts. Suitable older children are placed out with farmers.

There is an industrial school at Caversham, reorganization of which as recommended by the committee is being carried out. There is also a boy's training farm at Weraroa. Twenty special classes

have been established in connexion with special schools in the large towns.

Though many male teachers wish to take up mental deficiency work, they are not permitted to do so.

The Education Department deals with all children committed to the care of the State from causes varying from destitution to delinquency. The delinquents are in the hands of the Child Welfare Branch and Borstal Committees. The policy of the Department is wherever possible to board the children out, even a humble home being rightly regarded as better than an institution.

A survey of intelligence quotients has been made by the Education Department in a large number of districts, but the results of it will not be available until they are verified.

Some excellent work I am told is being done in some of our asylums in training apparently hopeless imbeciles by means of Montessori methods and farm work.

At the Roman Catholic Home for cripple children in Wellington I found ten years ago a nun using Montessori methods with improvized material. Soon after that time Dr. Montessori's own material was secured.

The committee complains that there is no provision for the education of the epileptic child and that owing to the fact that magistrates and medical men are reluctant to commit the legally feebleminded to asylums, there is a tendency for the special residential schools to be filled with unimprovable persons suitable for a custodial institution.

The committee states that the special residential schools have modern and well equipped day schools with trained women teachers and express satisfaction with special classes in connexion with our public schools.

The committee states (Section 4) that wherever possible training suitable for improvable types should be arranged in connexion with the ordinary public schools; special residential schools should be reserved for children who can be fitted to take their place in the community, (*a*) for those whose home is too remote for them to attend special classes, (*b*) for those who tend to become delinquent, (*c*) for those who require more continuous supervision.

The special schools should be used as a means of diagnosis of capability where prolonged observation is necessary to come to a conclusion.

Farm colonies and industrial colonies should be used as a place in which mental defectives who (*a*) being helpless are apt to be victims of the unscrupulous or (*b*) being antisocial are a menace to society, are placed.

The committee recommend the appointment of a skilled psychiatrist to sit on the eugenic board.

They also recommend the appointment by the Education Department of psychological experts in order to provide a comprehensive system providing increased facilities (*a*) for the study of the individual child in school, (*b*) for the classification of children according to their mental capacities, (*c*) for the adaptation of the curriculum to the needs of special children.

Special classes may need to be increased. Residential special schools may need to be made for the social readjustment of children when required.

It has been said that the sooner the general public realizes that mental disease is merely a manifestation of bodily disease the better. This view means that mental and moral causes of mental deficiency, that is mental disorder, do not exist. It means that the mind cannot be diseased, but only the body.

As I have pointed out, civilization is not hereditary and the legal definition of mental deficiency is a social one which refers to the degree not to the nature of the disorder. Yet we are asked to believe that a breakdown in the civilization of an individual can result only from bodily causes except perhaps in the case of delinquency.

Universal popular opinion denies this doctrine by the phrase: "It nearly drove me mad." Some of the greatest novelists and dramatists have throughout the ages denied it. In modern times psycho-analysis has proved it wrong and in the latest times we have seen develope a scientific study of the play of the emotional and moral environment in producing social break downs, not only by the careful taking of histories but by the continued prolonged observation of individuals. Carefully observed, true stories are confirming the pictures portrayed by the world's greatest writers of fiction.

Physiology must continue to work on the hypothesis that all the contents of the stream of consciousness must have a physical-chemical explanation, but we must not delude ourselves into thinking that we possess such an explanation now.

What psychological explanation can be given for the detail of conduct of a woman of thirty who several times a day would act as follows. She would run out of her room into an adjoining one and there take up a certain position at the table, ring for her maid and give her a trivial order or merely send her away and then run back again, or of a girl who must remove every clock from her bedroom, lock the door and collect the vases on a table, and who gives an illogical inconsistent explanation of her conduct.

Yet today such cases are being cured by purely mental means and during the process satisfactory mental causes are found for the symptoms and the meaning of the symptoms is revealed.

It is idle to pretend that our knowledge of physiology, of biochemistry or of bodily pathology can explain such cases in which the body is proved to be healthy. The only knowledge we have of such conditions is psychological and that knowledge is satisfactory in the practical results of its application.

Our attack on mental deficiency, therefore, must not be a mere campaign of physical hygiene, but while it includes that, it must devote special attention to the mental factor.

The education of mental defectives is a vast problem even apart from the fact that it is but one aspect of a general movement of mental hygiene. The dawning of a realization of its importance has come suddenly upon the world and upon us. We cannot, therefore, blame the Education Department for what I believe is a fact that the special training at present possessed by and being provided for teachers of backward and delinquent children is quite inadequate. It is, I believe, a world-wide difficulty at the present time to find enough psychiatrists with a knowledge of modern psychology, well qualified non-medical psychologists and well trained mental deficiency teachers and the like or others sufficiently qualified to give the training or even for the purpose of providing satisfactorily for the psychiatric needs of the community.

In New Zealand it is the Education Department and the educationalists who have displayed most interest in this problem, while the medical profession has failed to realize its duty and opportunity of insisting that the problem is ultimately a medical one of a very special kind.

The committee does not seem to have grasped this fact, but if effort is not to be misdirected and if the best results are to be obtained, a preliminary comprehensive examination of each child is necessary. Such an examination should be under the control of a psychiatrist with a knowledge not only of the physical causes but also of the mental mechanisms of mental disorder and it should be repeated as occasion demands. He should have at his disposal non-medical psychologists and internists to assist him in making his diagnosis.

In our special schools and in our reformatories I strongly suspect that provision for treatment is far ahead of provision for diagnosis. The importance of diagnosis is shown by the fact that quite a large proportion of problem children in New York have been found to be of supernormal intelligence. The indications for treatment in such cases are quite different from what obtains in defective intelligence. It is possible for either supernormal intelligence or defective intelligence to be an important factor in determining theft.

The committee recommend for the education board the appointment of non-medical psychologists and of improved facilities in the University for training teachers. Its proposals though quite inadequate are the most important in the report for they tend towards the very kernel of the matter. They almost touch the very heart of the problem, for, what we need is a community movement and such a movement should radiate from our University. Special University training should be given not to the teaching profession alone, but first and foremost to the medical profession and also to the other liberal professions.

The problem of mental defect, that is mental disorder, is not first met in the schools as the committee claims. The nervous, perverse, delinquent child, the child with bad habits and characterological or dispositional faults is often met by the medical practitioner earlier still, but untrained as he is in psychology and having but a smattering of psychiatry, he neither understands what to do nor knows where to send the child. He may happen to be qualified as a result of private study to deal with such cases, but there is no organization for treatment of these conditions in the community and specialist private practitioners are few in number. Our aim should be to enable the general practitioner to be able to give sound advice on simple matters and to encourage the development of both public institutions and of private practitioners qualified to deal with more difficult cases. The lawyer and clergyman also have to deal with the mentally disordered and their training should give them more than a nodding acquaintance with the elements of the problem. This was recognized by the Ninth International Prisons Conference at which courses in psychology, criminology, sociology, forensic psychiatry and penology were recommended as part of the training of magistrates.

The most important single consideration in any scheme of social work, for example the education of mental defectives, is the personnel which must be not only of suitable character and disposition, but must also today be properly trained. Hence it is that the Faculty of Social Science providing both a theoretical and practical training of University standard for social workers is necessary. Our present diploma in social science prescribes an unsuitable and purely theoretic course. To provide for such practical work in sociology in connexion with the University the scheme propounded by Dr. Latham including a psychopathic hospital is necessary. We should also encourage the location in or near Dunedin where the Medical School is, as well as in or near other University towns, of State and other institutions dealing with the treatment or prevention of various types of social break downs. These would supplement the institutions we already have.

If the Otekaieke School were within reasonable distance from Dunedin both the teachers in it and the professors of education and the teachers interested in the medical school would exercise a reciprocal benefit on one another on this subject. Not only so, but it would be relatively easy to give every medical student and every teacher trained some real and first hand knowledge of the problem. The efficiency of the special school would be greatly increased and the inmates benefitted; while also each medical student and each teacher when qualified would become a torch bearer carrying a comprehension of the problem throughout the length and breadth of our islands.

It is a pity that Seacliff Mental Hospital is so far from Dunedin.

(To be continued.)

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